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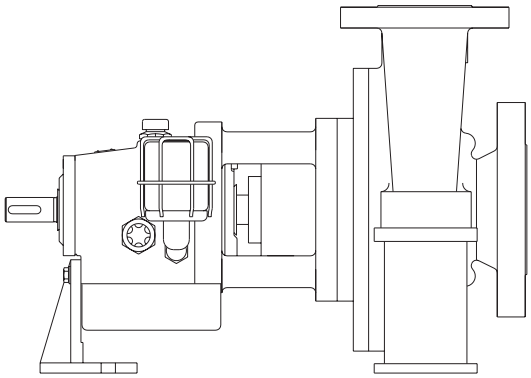
Instruction manual

CombiPro

Heavy duty process pump according to API 610 - 8th edition



CR/EN (0402) 3.0

JOHNSON PUMP

EC Declaration of conformity

(Directive 98/37/EC, appendix II-A)

Manufacturer
Johnson Pump Water B.V.
Dr. A.F. Philipsweg 51
P.O. Box 9
9400 AA Assen
Netherlands

hereby declares that the pump, in case it is delivered as an assembly with drive (last position of serial number = A), is in conformity with the provisions of Directive 98/37/EC (as altered most recently) and the following directives and standards:

- EC directive 73/23/EEC, "Electric equipment for use within certain voltage limits"
- standards EN 292 part 1 & 2, EN 809

The pump to which this declaration refers may only be put into operation after it has been installed in the way prescribed by the manufacturer, and, as the case may be, after the complete system of which this pump forms part, has been made to fulfil the requirements of Directive 98/37/EC (as altered most recently).

Manufacturer’s declaration

(Directive 98/37/EC, appendix II-B)

Manufacturer
Johnson Pump Water B.V.
Dr. A.F. Philipsweg 51
P.O. Box 9
9400 AA Assen
Netherlands

hereby declares that the pump, in case it is delivered without drive (last position of serial number = B), is in conformity with the following standards:

- EN 292 parts 1 & 2, EN 809

and that this pump is meant to be incorporated in or combined with another machine (electric motor, combustion engine) and may only be put into use after the complete machine of which the pump under consideration forms part has been made and declared to comply with that directive.

Assen, Janary 1st 2004

P. Ressenaar
Director

Instruction manual CombiPro

Johnson Pump Water BV (hereafter called Johnson Pump) is part of Johnson Pump International AB. The core activities of Johnson Pump International AB are the development, production, sale and maintenance of pumps and pump units.

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1 Introduction

1.1 Introduction

This manual contains important and useful information for the proper operation and maintenance of this pump. It also contains important instructions to prevent potential accidents and damage, and to ensure safe and fault-free operation of this pump.

! **Read this manual carefully before commissioning the pump, familiarize yourself with the operation of the pump and strictly obey the instructions!**

The data published here comply with the most recent information at the time of going to press. However they may be subject to later modifications.

Johnson Pump reserves the right to change the construction and design of the products at any time without being obliged to change earlier deliveries accordingly.

1.2 Safety

This manual contains instructions for working safely with the pump. Operators and maintenance staff must be familiar with these instructions.

Below is a list of the symbols used for those instructions and their meaning:

⚠ ***Personal danger for the user. Strict and prompt observance of the corresponding instruction is imperative!***

! **Risk of damage or poor operation of the pump. Follow the corresponding instruction to avoid this risk.**

➢ *Useful instruction or tip for the user.*

Items which require extra attention are shown in **bold print**.

This manual has been compiled by Johnson Pump with the utmost care. Nevertheless Johnson Pump cannot guarantee the completeness of this information and therefore assumes no liability for possible deficiencies in this manual. The buyer/user shall at all times be responsible for testing the information and for taking any additional and/or deviating safety measures. Johnson Pump reserves the right to change safety instructions.

1.3 Guarantee

Johnson Pump shall not be bound to any guarantee other than the guarantee accepted by Johnson Pump. In particular, Johnson Pump will not assume any liability for explicit and/or implicit guarantees such as but not limited to the marketability and/or suitability of the products supplied.

The guarantee will be cancelled immediately and legally if:

- Service and/or maintenance is not undertaken in strict accordance with the instructions.
- The pump is not installed and operated in accordance with the instructions.
- Necessary repairs are not undertaken by our personnel or are undertaken without our prior written permission.
- Modifications are made to the products supplied without our prior written permission.
- The spare parts used are not original Johnson Pump parts.
- Additives or lubricants used are other than those prescribed.
- The products supplied are not used in accordance with their nature and/or purpose.
- The products supplied have been used amateurishly, carelessly, improperly and/or negligently:
- The products supplied become defective due to external circumstances beyond our control.

All parts which are liable to wear are excluded from guarantee.

Furthermore, all deliveries are subject to our "General conditions of delivery and payment", which will be forwarded to you free of charge on request.

1.4 Service and support

This manual is intended for engineering and maintenance staff and for those who are in charge of ordering spare parts.

1.4.1 Ordering spare parts

This manual contains the spare parts recommended by Johnson Pump as well as the instructions for ordering them. A fax-order form is included in this manual. If you have any questions or require further information with regard to specific subjects then do not hesitate to contact Johnson Pump.

1.4.2 Pump number

The pump number is stamped on the type plate of the pump.
For correspondence and when ordering spare parts you should always state this number and the other information on the type plate.

➢ *The pump information is also stated on the label on the front of this manual*

1.5 Checking goods delivered

Check the consignment immediately on arrival for damage and conformity with the advice note. In case of damage and/or missing parts, have a report drawn up by the carrier at once.

1.6 Transport instruction

1.6.1 Dimensions and weight

The CombiPro range pump units are generally too heavy to be moved by hand. Therefore, use the correct transport and lifting equipment. The weight of this pump (unit) is shown on the label in the front of this manual. For dimensions of the pump unit see chapter 8.

1.6.2 Use of pallets

The CombiPro is packed on a pallet. Leave the pump on the pallet as long as possible. This prevents unnecessary damage and makes transporting the pump easier if the pump has to be moved again for installation.

! Use of a forklift truck: always set the forks as far apart as possible and lift the pallet using both forks.
Avoid jolting the pump when moving it.

1.6.3 Hoisting

When hoisting a pump or complete pump units the straps must be fixed in accordance with figures 1 and 2

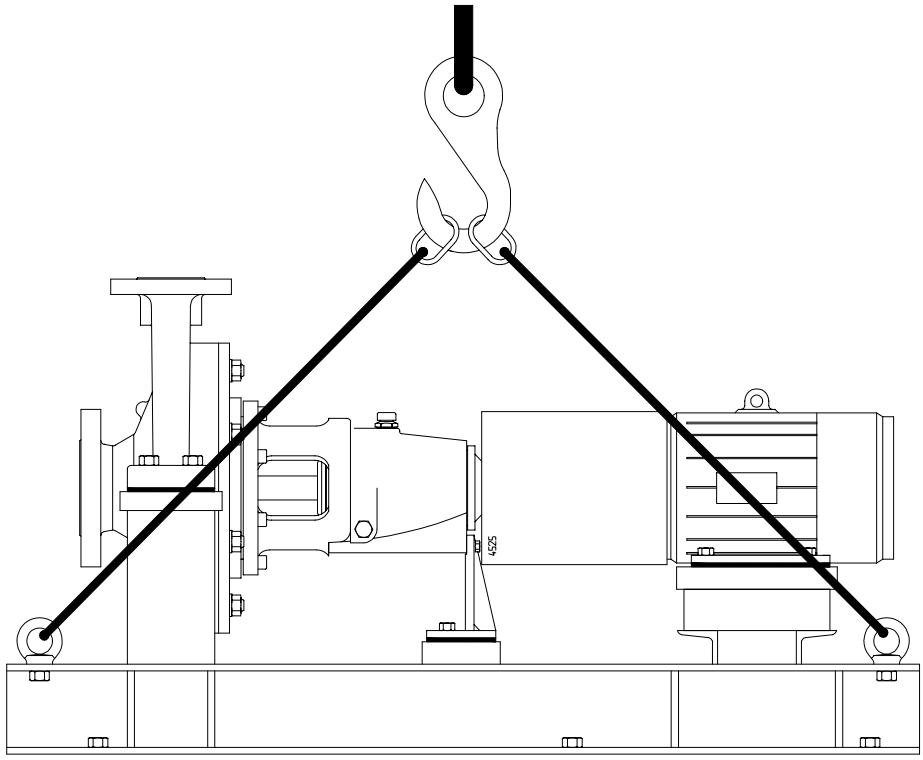


figure 1: Lifting instruction pump unit.

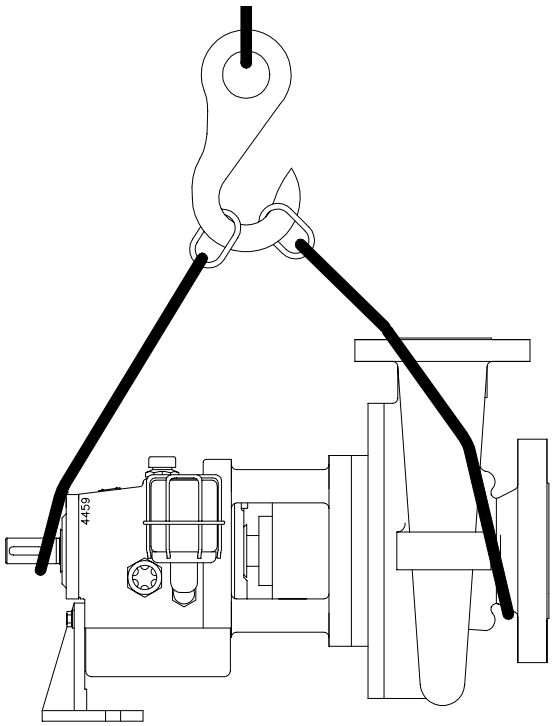


figure 2: Lifting instruction single pump.

⚠ ***Never stand underneath a hoisted pump!***

1.7 Storage

If the pump is not to be used immediately the pump shaft must be turned by hand twice per week.

2 General

2.1 Pump description

The CombiPro is a series of horizontal 'heavy duty' centrifugal pumps. The design of this pump is based on the guidelines: "Centrifugal Pumps for General Refinery Services" of the "American Petroleum Institute" otherwise known as the API Standard 610. The CombiPro range therefore meets the high requirements which have been set by the refineries and the petrochemical industry.

The API 610 contains important technical guidelines in order to guarantee optimum reliability. The CombiPro amply complies with these requirements. This has been demonstrated through extensive research and can be supported on the basis of advanced methods of calculation.

2.2 Applications

In general, CombiPro pumps are suitable for thin, clean and lightly contaminated liquids.

The maximum allowed system pressure and temperature and the maximum speed are dependent upon the pump type and design. You can find data concerning this in 10.6. Further information about the application options of your specific pump can be found in the order confirmation and/or the accompanying datasheet.

We advise against using the pump for an application which differs from that for which the pump was originally supplied, without discussing this with your supplier first.

Using a pump in a system or under system conditions (liquid, system pressure, temperature, etc.) for which it has not been designed can create danger for the user!

2.3 Construction

The CombiPro has been constructed in accordance with a rigorously applied modular construction method:

- For each pump type the pump casing and the impeller, in the various types of materials, are structurally the same and interchangeable. In principle this means that the hydraulic performances are fixed. The required capacity and head are obtained by selecting the pump speed and if necessary by reducing the impeller diameter.
- The pumps are divided into three bearing groups. Each bearing group only has one pump shaft and one bearing arrangement.
- The pumps are also standardized into six groups with the same connection for the pump casing and pump cover, depending on the nominal impeller diameters. For each combination of shaft and nominal impeller diameter there is one pump cover, in various materials, and one bearing bracket which is made from nodular cast iron or carbon steel.
- Various material variants can be used for components which come into contact with the pumped liquid.

The most important parts are:

- Pump casing
- Impeller
- Mechanical shaft sealing
- Bearing

2.4 Pump casing

On the suction side of the impeller the pump casing is provided with a renewable wear ring. An anti-rotation partition is fitted into the inlet. The centering edge for the pump cover is located on the outside of the packing for the pump casing and does not therefore come into contact with the liquid.

The suction and discharge flanges are designed in accordance with ANSI B16.5 300 lbs (ISO 7005 PN50), and it is also possible to supply the flanges drilled in accordance with the ANSI B16.5 150 lbs (ISO 7005 PN20). The outside diameter and the thickness of the inlet and outlet flanges are, in this case, in accordance with ANSI B16.5 300 lbs. The flanges can be designed as either "raised faced" or as "flat faced". The sealing face of the flanges can be finished in various machining patterns and roughnesses, such as "stock finished" and "smooth finished". The drain for the pump casing is designed with a screw thread connection or with weld connections such as "socket-welded" and "butt-welded".

2.5 Impeller

2.5.1 Closed impeller

The back of the closed impeller is provided with back vanes in order to limit the pressure on the shaft seal and to allow the flushing liquid to circulate. Contamination of the shaft seal is also prevented. On the inlet side the impeller is provided with an interchangeable wear ring. The sealing splits of the impeller are, conforming to the values, in accordance with API 610. In other words these are dependent on the diameter and type of material.

2.5.2 Semi-open impeller

The semi-open impeller is fully interchangeable with the enclosed impeller. The wider bore makes the semi-open impeller suitable for liquids with solid particles. The rear wall of the semi-open impeller is almost fully open at the location of the

pump cover. The front wall is also partially open between the vanes. Therefore, an ample bore is created as a result of which impeller blockage occurs less rapidly.

2.5.3 Half open impeller

A half open impeller can be used for special applications. A wear plate is fitted into the pump casing, along which the vanes rotate at close distance. The half open impeller is easy to clean when liquids which easily bond to the wall are being pumped. Blockage of the impeller also occurs less rapidly.

2.6 Pump cover

The pump is designed to fit any seal type in accordance with API 682. In collaboration with various suppliers of mechanical seals the design has been closely evaluated in order to be able to build in the required variants.

2.7 Wear rings

Both the impeller and the pump casing are fitted with a renewable wear ring. The casing wear ring has a hardness at least 50°Br over the impeller wear ring. The rings are secured by three lock screws.

2.8 Mechanical seal

The various designs of pumps are created by the addition of shaft seal "cartridges". These "cartridges" are standardized in the same three groups as the pump shafts and are designed in accordance with API 682.

2.9 Bearing

- The bearing construction consists of two angular contact bearings (in "O" arrangement) combined with a cylindrical bearing. The bearings are oil lubricated. The oil level is kept constant by means of a constant oil leveler. The bearings on the coupling side with which the axial force is taken up are retained on the shaft by a shaft nut. The outer ring of these bearings is retained by the bearing cover.
- The cylindrical bearing on the impeller side takes up radial forces and is mounted "floating" on the outer ring. As a result of this the machining tolerances and expansions can be easily accommodated. The bearing arrangement is sealed by labyrinth rings.
- If required, the oil bath can be provided with cooling for example when the ambient temperature is higher than 45°C, or in other extreme applications. The underside of the bearing bracket is provided with an option for creating a cooling chamber.

2.10 Base plate and coupling

A unique base plate is made for each pump/motor combination. This is designed in the most optimum way for the relevant combination. The base plate is assembled from steel sections and is of an open design so that it can be grouted into concrete. This provides maximum rigidity to the structure so that forces from the network of pipes cannot cause any alignment error in the coupling. A drip pan under the entire pump collects all leakage liquid and discharges this to the drain point, which has a 2" connection. Adjustment bolts are provided in the base plate for accurate horizontal adjustment of the entire unit. Pump and motor are assembled with a flexible coupling with spacer (so called "Spacer coupling"). As a result of this it is possible to disassemble the pump without having to remove the motor and the pump casing from the base plate. This is known as the "back-pull-out" principle. For the coupling a selection can be made between a type with flexible rubber elements or a stainless steel diaphragm set.

2.11 Type code

The CombiPro range of pumps can be supplied in several designs. The main features of the pump are shown in the type code.

CR 50A-200 A-8 1A 11

CR	Abbreviated designation for **C**ombiP**R**o		
50A	Discharge connection [mm]. A and B design pump types have the same designation though they have different hydraulic performances		
200	Nominal impeller diameter [mm]		
A-8	Material designation code. Material combinations according to API 610		
	Code API 610	Pump casing material	Impeller material
	S-1	carbon steel	cast iron
	S-6	carbon steel	13% Cr-steel
	S-8	carbon steel	stainless steel (316)
	C-6	13% Cr-steel	13% Cr-steel
	A-8	stainless steel (AISI 316)	stainless steel (AISI 316)
1A	Mechanical seal code according to API 682		
	1A	Single seal arrangement 1 type A, pusher type seal	
	1B	Single seal arrangement 1 type B, metal bellows rotating flexible element	
	1C	Single seal arrangement 1 type C, metal bellows stationary flexible element	
	2A	Arrangement 2 Dual seal with unpressurized buffer lower than product type A, pusher type seal	
	2B	Arrangement 2 Dual seal with unpressurized buffer lower than product type B, metal bellows rotating flexible element	
	2C	Arrangement 2 Dual seal with unpressurized buffer lower than product type C, metal bellows stationary flexible element	
	3A	Arrangement 3 Dual seal with pressurized buffer higher than product type A, pusher type seal	
	3B	Arrangement 3 Dual seal with pressurized buffer higher than product type B, metal bellows rotating flexible element	
	3C	Arrangement 2 Dual seal with pressurized buffer lower than product type C, metal bellows stationary flexible element	
11	Mechanical seal "flush plan" according to API 682		
	Plan 11	Recirculation from pump discharge through a flow control orifice to the seal	
	Plan 52	External reservoir providing buffer fluid for the outer seal of an unpressurized dual seal arrangement	
	Plan 53	Pressurized external barrier fluid reservoir supplying clean fluid to the seal chamber	

2.12 Application area

Overall, the application area is as follows:

	Maximum
Capacity	350 m^3/h
Delivery head	160 m
System pressure	3500 kPa (35 bar)
Temperature range	-30 to +350°C
Viscosity	300 mm^2/s

2.13 Re-use

The pump may only be used for other applications after prior consultation with Johnson Pump or your supplier. Because the medium which was pumped last is not always known, the following instructions should be observed:

1 Flush the pump properly.
2 Make sure the flushing liquid is discharged safely (environment!).

⚠ ***Take adequate safety measures (collection trough) and use the correct personal protection equipment (rubber gloves, spectacles)!***

2.14 Scrapping

If it is decided to scrap a pump, then the same steps as 2.13 (Re-use) must be followed first.

3 Installation

3.1 Safety

3.1.1 General

Read this manual carefully prior to installation and commissioning.
Non-observance of these instructions can result in serious damage to the pump and this will not be covered under the terms of our guarantee. Follow the instructions given step by step.

3.1.2 Pump unit

- Ensure that the pump can not be started if work has to be undertaken to the pump during installation and the rotating parts are insufficiently guarded.
- Depending on the design the pumps are suitable for liquids with a temperature of up to 350°C. When installing the pump unit to work at 70°C and above the user should ensure that appropriate protection measures and warnings are fitted to prevent contact with the hot pump parts.
- If there is danger of static electricity, the entire pump unit must be earthed.
- If the liquid being pumped can cause danger for man or the environment, measures must be taken to drain the pump in a safe way!

3.2 Protection

In order to prevent corrosion, the inside of the pump is treated with a preserving agent before leaving the factory. Before commissioning the pump remove any preserving agents and flush the pump thoroughly with hot water.

3.3 Environment

- The foundation must be hard, level and flat.
- The area in which the pump is installed must be sufficiently ventilated. An ambient temperature or air humidity which is too high, or a dusty environment, can have a detrimental effect on the operation of the electric motor.
- There should be sufficient space around the pump unit to operate and if necessary repair it.
- Behind the cooling air inlet of the motor there must be a free area of at least 1/4 of the electric motor diameter, to ensure unobstructed air supply.

3.4 Pump unit

⚠ ***Ensure that the pump can not be started if work has to be undertaken to the pump during installation and the rotating parts are insufficiently guarded.***

3.4.1 Positioning

The pump shaft and motor shaft of complete units are fitted accurately together in the factory. For permanent installation use shims to ensure that the base plate is level on the foundation. Then carefully tighten the nuts on the foundation bolts. After that, check the setting of the pump and motor shaft and readjust as required. It is preferred that the 2 base plate supporting flanges are cast into concrete.

3.4.2 Assemble

If the pump and the electric motor still have to be assembled, proceed as follows:

1 Fit **-without impact tool-** both halves of the coupling to the pump shaft and the motor shaft respectively.
2 Position the pump on the foundation and secure it with bolts.
3 Place the electric motor on the foundation. Mount shims of at least 5 mm between the base plate and the pump and/or the electric motor. Place copper shims under the feet of the electric motor. Secure the electric motor with bolts and ensure there is a gap of 3 mm between both coupling halves.
4 Align the coupling in accordance with the following instructions.

3.4.3 Align the coupling

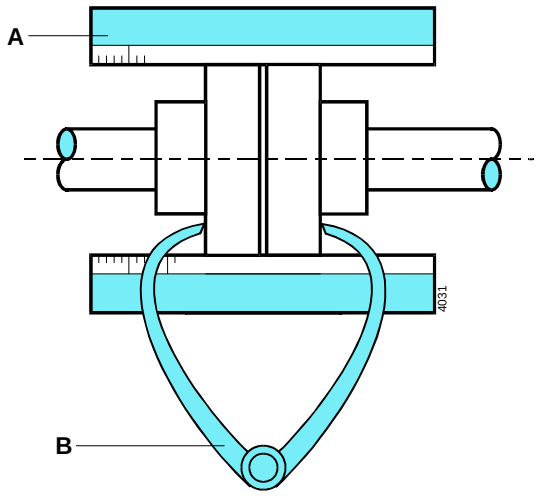


figure 3: Alignment of the coupling.

! Alignment of the coupling halves may only take place by moving the electric motor!

1 Place a ruler (A) on the coupling. Remove or add as many shims as is necessary to bring the electric motor to the correct height so that the straight edge touches both coupling halves over the entire length (see figure 3).
2 Repeat the same check on both sides of the coupling at the height of the shaft. Move the electric motor so that the straight edge touches both coupling halves over the entire length.
3 To be certain the check is also undertaken using external callipers (B) at 2 diametrically opposed points on the sides of the coupling halves (see figure 3).

4 Repeat this check at operating temperature and spend time achieving minimum alignment deviation.

5 Fit the protecting guard.

See figure 4 and the corresponding table for the maximum permissible tolerances during setting of the coupling halves.

External diameter of coupling [mm]	V				Va_{max} - Va_{min} [mm]	Vr_{max} [mm]
	min [mm]		max [mm]			
81-95	2	**5***	4	**6***	0,15	0,15
96-110	2	**5***	4	**6***	0,18	0,18
111-130	2	**5***	4	**6***	0,21	0,21
131-140	2	**5***	4	**6***	0,24	0,24
141-160	2	**6***	6	**7***	0,27	0,27
161-180	2	**6***	6	**7***	0,30	0,30
181-200	2	**6***	6	**7***	0,34	0,34
201-225	2	**6***	6	**7***	0,38	0,38

***) = coupling with spacer**

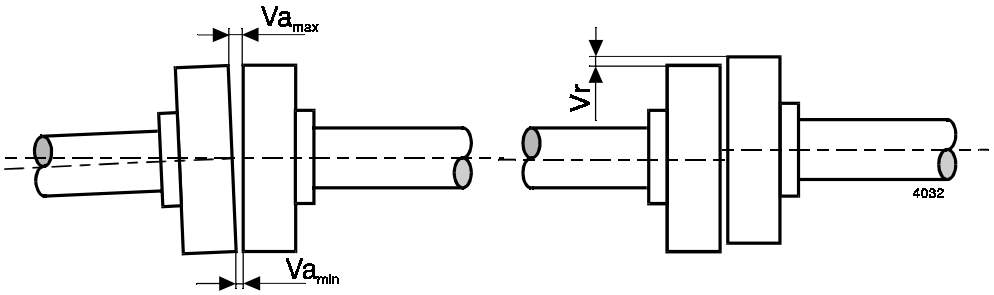


figure 4: Alignment tolerances.

3.5 Piping

- The CombiPro is not a self-priming pump, as a rule the liquid must flow into the pump.
- The suction and pressure pipes must connect perfectly and be free of tension during operation. The maximum permissible forces and torques at the pump flanges are stated in 10.8.
- The suction pipe bore must be adequately dimensioned.
  This pipe must be as short as possible and lead to the pump in such a way that no air pockets can be created. If this is not possible, a venting facility must be fitted at the highest point. If the suction pipe has a larger bore than the suction connection on the pump then an eccentric reducer must be used, so that no turbulence can be created, see figure 5.

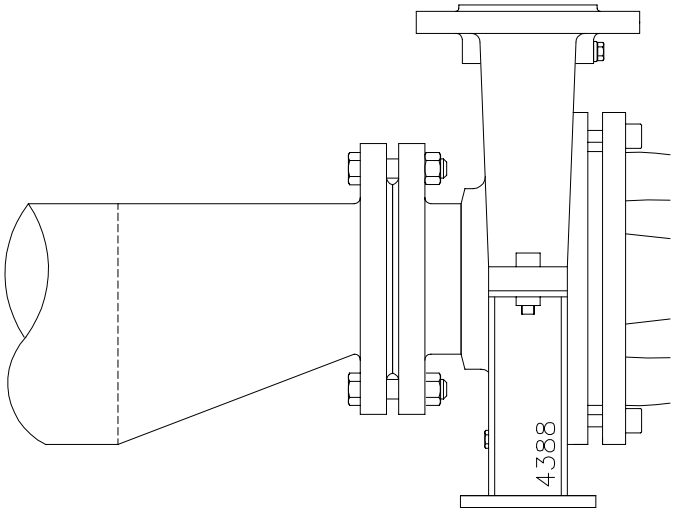


figure 5: Excentric reducer to the suction flange.

- The maximum permissible system pressure is stated in 10.6. If there is a chance that this pressure is exceeded, by, for instance, an excessive inlet pressure, take adequate measures against this. This can be achieved by installing a safety valve in the piping.
- Due to sudden changes in the flowspeed high pressure surges can occur in the pump and the piping (water blow). Therefore do not use any rapidly closing shut-off valves, valves and such like.
- Before the pump is installed thoroughly flush the pipe first in order to remove dirt, grease or any particles which are present in the pipes. We recommend that you fit a fine gauze temporarily in front of the pump inlet.
- Assemble any loose components.

3.6 Connecting the electric motor

⚠ ***The electric motor must be connected to the mains by an approved electrician, according to the locally prevailing regulations of the electricity company.***

- Refer to the instruction manual belonging to the electric motor.
- If possible, mount a working switch as close as possible to the pump.

4 Commissioning

4.1 Preparation

- Check if the shaft can rotate freely. Do this by turning the shaft end at the coupling a few times by hand.
- Check if the fuses are fitted.
- Check that the setting for the thermal protection switch corresponds with the specification on the type plate on the electric motor;
- The pump is supplied with an oil lubricated bearing construction and **is delivered without oil**. Flush the bearing housing with petrol or benzol first. Then, fill the bearing housing via the oil filler (shut off with oil fill plug (2270)) until the oil appears in the constant level oiler (2280). After this, fill the constant level oiler. See the indication plate (see fig 6) for the right oil level. See 10.4 for the relevant specifications of the oil to be used.

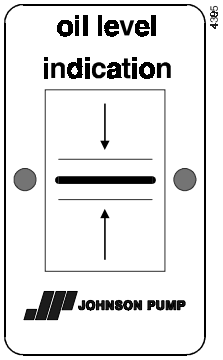


figure 6: Oil level indication

4.2 Preparing for commissioning

Proceed as follows, both when the unit is put into operation for the first time and after the pump has been repaired:

1 Fully open the stop valve in the suction pipe. Close the delivery stop valve.
2 Fill the pump and the suction pipe with the liquid to be pumped.
3 Rotate the pump shaft vigorously a few times by hand. Top up the pump as necessary.

4.3 Checking the direction of rotation

⚠ ***When checking the direction of rotation look out for any unguarded rotating parts!***

1 The direction of rotation of the pump is shown by an arrow on the bearing housing. Check if the direction of rotation of the motor corresponds with that of the pump.
2 Only switch the motor on for a brief period and check the direction of rotation.
3 If the sense of rotation is **not** correct, alter the sense of rotation. See the the instructions in the user manual belonging to the electric motor.
4 Fit the protecting guard.

4.4 Switching on the pump

⚠ ***Make sure that the rotating parts are always sufficiently guarded when the pump is running!***

1 Open the valve in the flushing or cooling liquid supply pipe if the pump is fitted with flushing or jacket cooling.
2 Switch on the pump.
3 Once the pump is up to pressure, slowly open the pressure cock. Check the power consumption of the electric motor.
4 Now open the outlet valve fully until the pump reaches the correct duty point. Check the power consumption again.

4.5 Check

If a pump is in operation pay attention to the following:

! **The pump should never run dry.**

- Check if the system pressure always remains below the maximum permissible working pressure. For the correct values, see 10.6.
- Never use the stop valve in the suction pipe to control pump capacity. This must always be fully open.
- Check if the differential pressure between the suction and the pressure connections corresponds with the specifications of the working point of the pump.
- Check if the absolute inlet pressure is sufficient so that no condensation can form in the pump. This can result in cavitation. The **minimum required inlet pressure** (in m) above the vapour pressure of the liquid being pumped at pump temperature must be **at least 0.5 - 1 m above the NPSH values** of the pump (NPSH = Net Positive Suction Head).

! **Cavitation must always be prevented, since this is very harmful to the pump.**

4.6 Noise

The noise generated by a pump depends to a large extent on the operating conditions. The values stated in paragraph 10.10 are based on normal use of the pump, driven by an electric motor. When being used outside of the normal area of application, with large capacities or with cavitation, the noise level can exceed 85 dB(A). Preventative measures must then be taken, such as fitting noise insulation around the pump unit or wearing ear protectors.

5 Maintenance

5.1 Daily maintenance

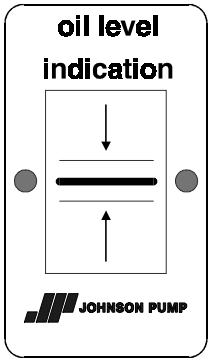


figure 7: Oil level

5.1.1 Check

- Regularly check the oil level, see fig 7.
- Regularly check the outlet pressure.

5.1.2 Cleaning the pump room

No water should get into the terminal box of the electric motor when the pump room is sprayed clean !
Never spray water on hot pump parts! These parts can burst if subject to sudden cooling and the hot pump liquid can then come out.

5.1.3 Mechanical seal

A mechanical seal generally requires no maintenance, however, it should never be allowed to run dry. If there are no problems it is not advisable to dismantle. Because the facing surfaces are running in on one another dismantling always means replacement of the seal. When the seal is leaking it has to be replaced.

5.2 Lubrication of the bearings

- The constant level oiler should never be empty during operation. It must therefore be topped up in time.
- **The oil must be replaced every 5000 hours of operation.** It must be replaced more frequently for higher environmental temperatures (e.g. in the boiler house). You can find the recommended oil grades in 10.4.

➢ *Make sure that the used oil is discharged safely. See to it that no oil gets into the environment.*

5.3 Environmental influences

- Regularly clean the filter in the suction pipe or the suction strainer at the bottom of the suction pipe, because the inlet pressure may become too low if the filter or the suction strainer is blocked.
- If the unit is out of operation and there is the danger that the pumped liquid will expand as a result of solidifying or freezing, it should be drained and if neccessary be flushed.
- If the pump is put out of operation for a longer period it should be treated with a preserving agent and periodically the pump shaft has to be turned several times.

5.4 Noise

If, after some time, the pump starts making a noise this may indicate that something is wrong with the pump. A crackling noise in the pump may indicate cavitation, an excessive motor noise can be an indication of decreasing bearing quality.

5.5 Fault

⚠ ***If you want to establish the nature of a fault, remember that the pump may be under pressure or the contents may be hot, poisonous, aggressive or flammable. Take the correct safety measures and protect yourself (gloves, safety goggles,..)***
Make sure that sufficient safety measures have been taken in area around the pump (collection tray, fire-blankets, eye bath, etc.).

! The cause of electrical faults can also be in the wiring. In that case call in a recognized electrical contractor.

If you are sure that the problem concerns the pump, then proceed as follows:

1 Firstly, switch off the power supply to the pump. Secure the operating switch using a lock or remove the fuses.
2 Close the stop cocks.
3 Take a note of the nature of the fault.
4 Using chapter 6 try to trace the cause. Then take the appropriate measures, or:
Contact your installer!

6 Problem solving

Faults in a pump installation can have various causes. The fault may not be in the pump, it may also be caused by the pipe system or the operating conditions. Firstly, always check that installation has been executed in accordance with the instructions in this manual and that the operating conditions still correspond with the specifications for which the pump was purchased.

In general, breakdowns in a pump installation are attributable to the following causes:

1 Faults with the pump.
2 Breakdowns or faults in the pipe system.
3 Faults due to incorrect installation or commissioning.
4 Faults due to incorrect choice of pump.

A number of the most frequently occurring failures as well as their possible causes are shown in the table below.

Most common faults	Possible causes
Pump delivers no liquid	1 2 3 4 5 6 7 8 9 10 11 13 14 17 19 20 21 27 29
Pump has insufficient volume flow	1 2 3 4 5 6 7 8 9 10 11 13 14 15 17 19 20 21 28 29
Pump has insufficient head	2 4 5 13 14 17 19 28 29
Pump stops after start up	1 2 3 4 5 6 7 8 9 10 11
Pump has higher power consumption than normal	12 15 16 17 18 22 23 24 25 26 27 32 34 38 39
Pump has lower power consumtion than normal	13 14 15 16 17 18 20 21 28 29
Pump vibrates or is noisy	1 9 10 11 15 18 19 20 22 23 24 25 26 27 28 29 37 38 39 40
Bearings wear too much or become hot	23 24 25 26 27 37 38 39 40 42
Pump running rough hot or seizes	18 23 24 25 26 27 34 37 38 39 40 42

	Possible causes:
1	Pump or suction pipe not sufficiently filled or vented
2	Gas or air coming from the liquid
3	Air lock in the suction pipe
4	Suction pipe leaks air
8	The manometric suction head is too high
9	Suction pipe or suction strainer is blocked
10	Insufficient immersion of foot valve or suction pipe during operation of the pump
11	NPSH available too low
12	Speed too high
13	Speed too low
14	Wrong sense of rotation
15	Pump does not work at the correct duty point
16	Liquid density differs from the calculated density
17	Liquid viscosity differs from the calculated viscosity
18	Pump operates with too low liquid flow
19	Wrong pump selection
20	Obstruction in impeller or pump housing
21	Obstruction in the pipe system
22	Wrong installation of the pump unit
23	Pump and motor not correctly aligned
24	Rotating part running out of true
25	Rotating parts out of balance (i.e. impeller, pump shaft or coupling)
26	Pump shaft is running out of true
27	Bearings faulty or worn
28	Casing wear rings faulty or worn
29	Impeller is damaged
37	Axial retaining of impeller or pump shaft is defective
38	The bearings have been fitted incorrectly
39	Too much or too little ball bearing lubrication
40	Wrong or polluted lubricant
41	Contaminants in the liquid
42	Too high axial force due to excessive inlet pressure

7 Disassembly and assembly

7.1 Safety measures

7.1.1 Electrical connections

⚠ ***Take adequate measures to prevent the motor from being started whilst you are working on the pump. This is particularly important for electric motors which are remote started:***

- Place the pump operating switch, if fitted, in the "off" position.
- Place the pump switch in the switch box in the "off" position.
- If necessary, remove the fuses.
- Fit a warning board onto the switch box.

7.2 Tools

Assembly and disassembly require no special tools. However, such tools can facilitate certain jobs. If such is the case it will be indicated in the text.

7.3 Item numbers

The item numbers used in the following disassembly- and assembly instructions refer to the cross section drawings in chapter 9.

7.4 Drain pump

7.4.1 Draining the liquid

⚠ ***If the liquid being pumped is hot, then allow the pump to cool down before proceeding. Make sure you do not come into contact with the pumped liquid if this is hot or of an unknown composition!***

Before starting any disassembly the pump should be drained by removing the drain plug (0310). If necessary, close the valves in the suction and delivery pipe and in the flushing or cooling pipe to the shaft seal.
Take the following safety precautions if harmful liquids are pumped:

- Wear protective gloves, shoes, glasses, etc..
- Flush the pump properly.
- Make sure no liquid gets into the environment.
- Re-fit the drain plug (0310).

7.4.2 Oil draining

- Drain the bearing housing via the drain plug (2150).
- Re-fit the drain plug.

⚠ ***If possible, wear protective gloves. Regular contact with oil products can cause allergic reactions.***

7.5 Back-Pull-Out system

7.5.1 Principle

If a spacer coupling is used then the coupling spacer can simply be removed. After that the Back-Pull-Out unit, comprising the stuffingbox cover and the bearing bracket with the complete rotating section, can then be removed. In this way, the pump can be disassembled for the most part without loosening the inlet and outlet pipe. The motor can, therefore, remain in position. If the pump unit does not have a spacer coupling, then the motor should be taken off the base *before* disassembly.

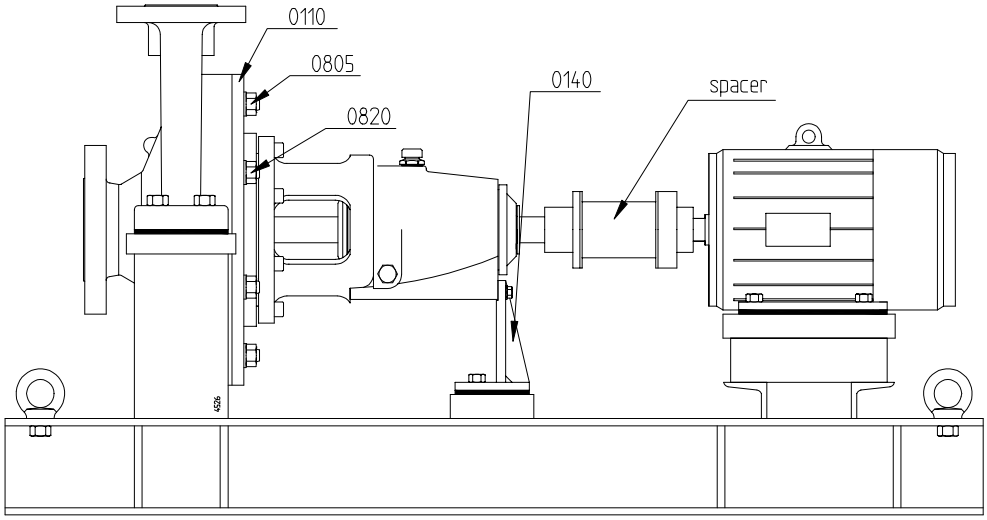


figure 8: Disassembly of the Back-Pull-Out unit.

7.5.2 Disassembly of the Back-Pull-Out unit

1 Disconnect possible flushing and/or cooling pipes.
2 Remove the spacer.
3 Loosen the bracket support (0140) from the base plate (see figure 8).
4 Remove the nuts (0805). Tighten alternately both bolts (0820) until the pump cover (0110) is released.
5 Pull the entire Back-Pull-Out unit from the pump casing. The entire Back-Pull-Out unit is particularly heavy. Support it with, for instance, a beam or suspend it with a rope in a hoist.

7.5.3 Assembly of the Back-Pull-Out unit

1 Place a new gasket (0300) in the pump cover and re-assemble the complete Back-Pull-Out unit in the pump casing. Tighten the nuts (0805) crossways.
2 Fasten the bracket support (0140) at the base.
3 Assemble the intermediate stage of the spacer coupling or re-position the electric motor.
4 Check the alignment of the pump and motor shaft (see 3.4.3). If necessary, re-align in operating position.

7.6 Replacing the w

The play diamete
mm on supply. If
rings are replace

7.6.1 Disassembly of th

1 Disassemble
2 Unlock the se
3 Disassemble
instance 2 big
(0110)).
4 Disassemble

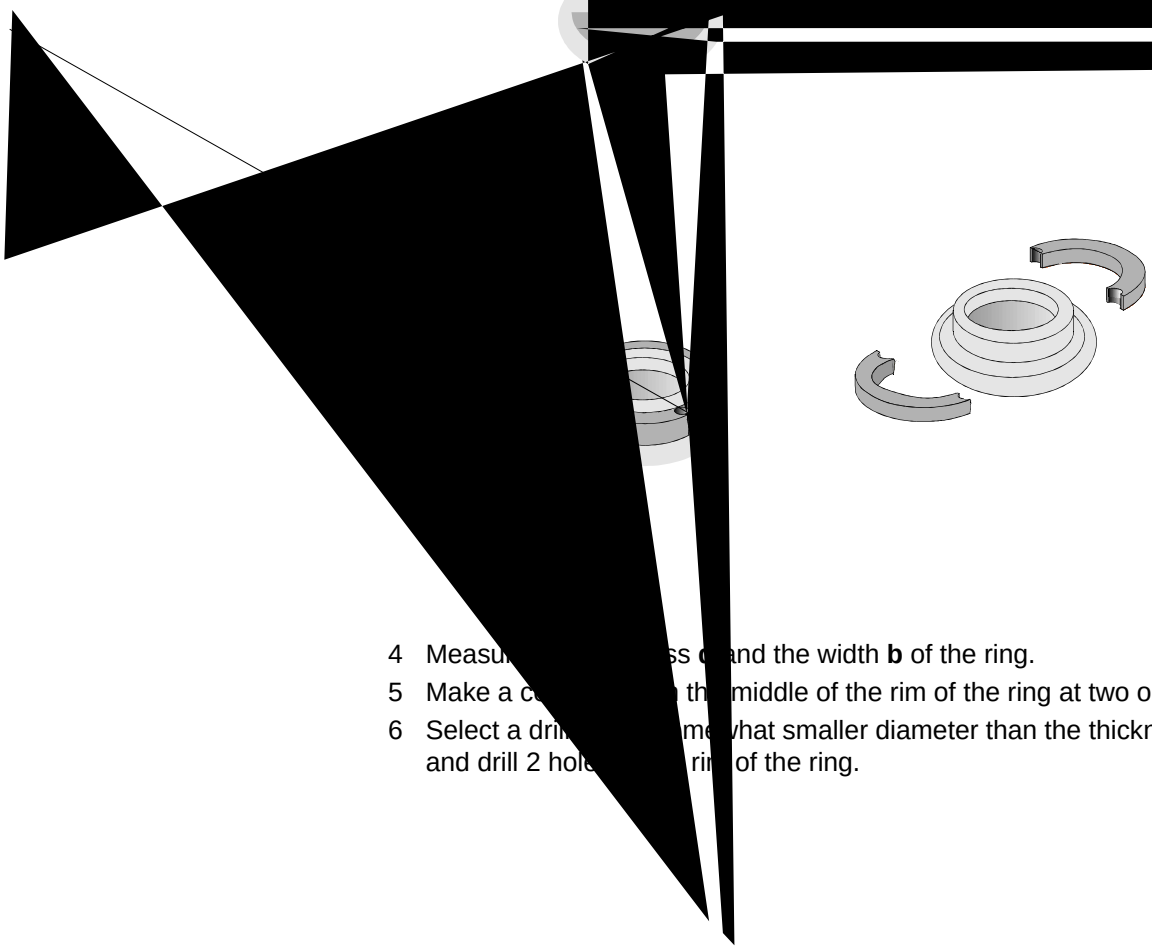
7.6.2 Assembly of the i

1 Fit the impelle
2 Push the impe
3 Fit the impelle
4 Fit the Back-P

7.6.3 Disassembly of th

1 Disassemble
2 Disassemble
impeller.
3 Disassemble
pump casing.

In most cases the
undamaged. Proc



4 Measu ss **c** and the width **b** of the ring.
5 Make a c th middle of the rim of the ring at two opposite points.
6 Select a dri me what smaller diameter than the thickness **d** of the ring and drill 2 hol ri of the ring.

Do not drill deeper than the width **b** of the ring
Take care not to damage the fitting edges of the pump casing and the impeller.

7 Use a chisel to cut away the remaining part of the ring thickness. The rings can then be removed in 2 sections.

8 Clean the pump casing and the impeller and carefully remove all drill shavings and metal splinters.

7.6.4 Assembly of the wear rings

1 Clean and degrease the wear rings (0130 en 0150) and the fitting edges of the impeller (0120) and the pump casing (0100).

2 Apply a few drops of Loctite 641 onto the **inside of wear ring (0150)** and fit the wear ring sliding it over the impeller entrance.

3 Apply a few drops of Loctite 641 onto the **outside of wear ring (0130)** and fit the wear ring sliding it into the pump casing.

! **Make sure that they are not inserted obliquely!**

4 Both wear rings then have to be secured. Drill 3 holes ∅5 mm, 9 mm deep, right on the seam between impeller and wear ring c.q. pump casing and wear ring. Subsequently cut screw thread M6 (see figure 10).

5 Apply a drop of Loctite 641 on each set screw (0135 and 0155) and fit them in their positions in the impeller and the pump casing respectively.

! **Don't fasten the set screws too tight, in order to avoid deformation of the wear rings!**

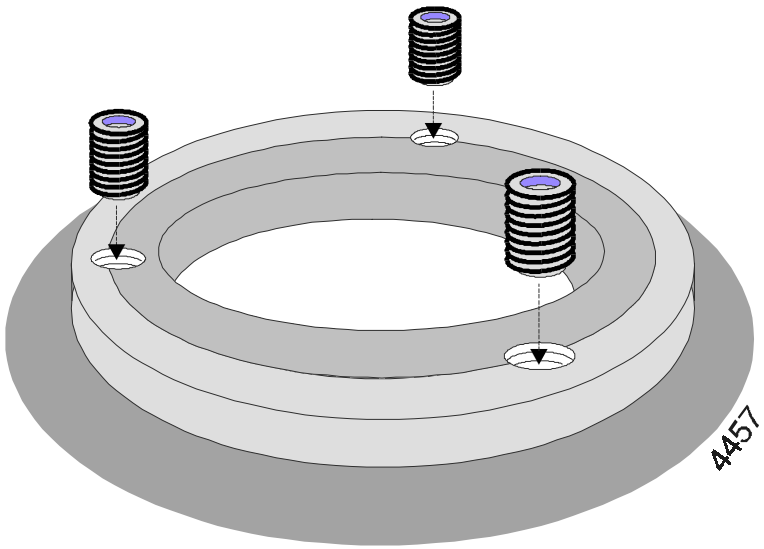


figure 10: Locking the wear rings.

7.7 Mechanical seal

7.7.1 Instructions for mounting a mechanical seal

➢ *First read the following instructions regarding the mounting of a mechanical seal. Follow these instructions closely when mounting a mechanical seal.*

- The mechanical seal comes as a 'full cartridge seal'. This means that the mechanical seal is mounted as one single piece and that it shall NOT be taken apart!
- A mechanical seal is a fragile precision instrument. Leave the seal in its original packing until you are ready to mount it!
- Clean all receiving parts properly. Make sure your hands and working environment are clean!

7.7.2 Disassembly of the mechanical seal

1 Re-fit the centering tabs on the seal cover into the groove in the seal collar in order to immobilise the seal.
2 Disassemble the impeller (see 7.6.1).
3 Remove the Allen screws and slide the mechanical seal backwards towards the bearing bracket (2100).
4 Remove the Allen screws (0850) and knock the pump cover loose from the bearing bracket.
5 Pull the entire seal cartridge from the pump shaft.

7.7.3 Assembly of the mechanical seal

1 Put the bearing bracket in upright position (impeller side up).
2 Push the seal cartridge onto the pump shaft.
3 Mount the pump cover (0110) in the correct position in the fitting edge of the bearing bracket (2100). Check whether the pump cover is at right angles to the pump shaft. Fasten the pump cover with Allen screws (0850).
4 Mount the mechanical seal against the pump cover (0110). Check the position in view of the connection points.
5 Mount the impeller and other parts (see 7.6.2 and 7.5.3).
6 Release the centering tabs, turn them halfway round and secure them again against the seal cover. The shaft must now be able to rotate freely.

7.8 Bearing

7.8.1 Instructions for assembly and disassembly of bearings

Stick closely to the following instructions when assembling and disassembling bearings:

Disassembly:

- Use **a proper puller** to remove the bearings from the pump shaft!
- If no proper puller is available, carefully knock on **the inner raceway** of the bearing. Use a normal hammer and a soft-metal drift. **Never knock the bearing with a hammer!**

Assembly:

- Make sure your workplace is clean and leave the bearings in their original packing as long as possible.
- **Preheat the bearings to 90° C** before mounting them on the pump shaft.
- If preheating is not possible: never knock the bearing directly. Use a mounting bush positioned against the inner raceway of the bearing and a normal hammer (a soft hammer might loose some splinters which could damage the bearing).
- **Never mount used retaining rings (2570)**: always use new rings!

7.8.2 Disassembly of the bearing

➢ *First read the instructions regarding assembly and disassembly.*

1 Disassemble the impeller and the mechanical seal (see 7.6.1 and 7.7.2).
2 Disassemble the coupling key (2210) and the bearing covers (2110 and 2115). Remove the gaskets (2160).
3 Knock the pump shaft (2200) on the impeller side so as to loosen the bearings from the bearing bracket. **Use a plastic hammer to avoid damage to the thread**. Remove the pump shaft with the bearings from the bearing bracket.
4 Remove both the inner circlips (2300) from the bearing bracket. Push the outer ring of the roller bearing (2250) out of the bearing bracket.
5 Knock the lip of the retaining ring (2570) out of the bearing lock nut (2560). Loosen the bearing lock nut. Use a puller to remove the bearings from the pump shaft.

7.8.3 Assembly of the bearing

➢ *First read the instructions regarding assembly and disassembly.*

1 Mount (at the impeller side) the inner ring (+ rollers) of roller bearing (2250) onto the pump shaft (2200). Mount (at drive side) the 2 angular contact ball bearings (2260) **in back-to-back position** (see figure 12) onto the pump shaft. Let the bearings cool down.
2 Fit the retaining ring (2570) and the bearing lock nut (2560). Tighten the bearing lock nut and secure it by knocking a lip of the retaining ring into the opening of the bearing lock nut.
3 Mount both the inner circlips (2300) into the bearing bracket (2100).
4 Press the outer ring of the roller bearing (2250) into its boring in the bearing bracket, using a proper pressure piece.
5 Check if the oil baffles (2120 and 2125) are not worn out. Replace them if necessary.
6 Mount the bearing cover (2110) using a new gasket (2160).
7 Press the pump shaft with the bearings carefully into the bearing bracket until the nearest angular contact ball bearing touches the outer circlip. **Take care not to damage the rollers of the roller bearing**.
8 Mount the bearing cover (2115) using a new gasket (2160).
9 Mount the mechanical seal and the impeller (see 7.7.2 and 7.6.1).

8 Dimensions

8.1 Dimension print

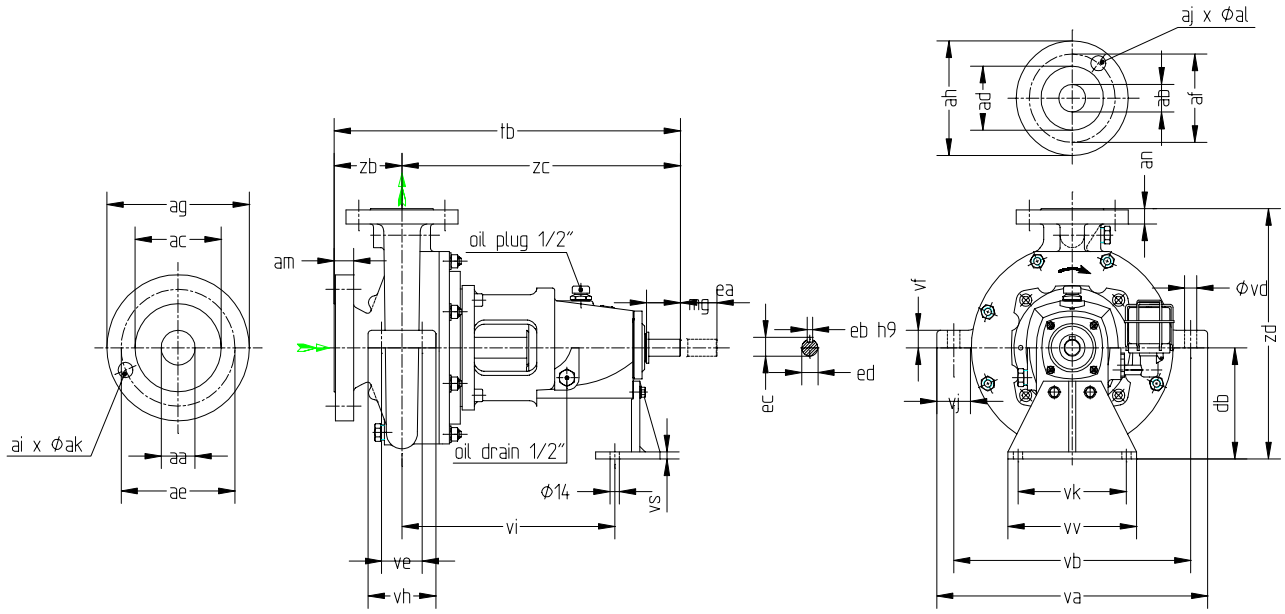


figure 11 Dimension print

8.2 Flange dimensions ANSI B16,5 150lbs (ISO7005 PN20)

aa	ab	ac	ad	ae	af	ag	ah	ai*ak	aj*al	am	an
50	40	92	73	120,5	98,5	165	156	4*18	4*16	22	21
80	50	127	92	152,5	120,5	210	165	4*18	4*18	29	22
100	80	157	127	190,5	152,5	254	210	8*18	4*18	32	29
150	100	216	157	241,5	190,5	318	254	8*22	8*18	37	32
200	150	270	216	298,5	241,5	381	318	8*22	8*22	41	37

8.3 Flange dimensions ANSI B16,5 300lbs (ISO7005 PN50)

aa	ab	ac	ad	ae	af	ag	ah	ai*ak	aj*al	am	an
50	40	92	73	127	114,5	165	156	8*18	4*22	22	21
80	50	127	92	168,5	127	210	165	8*22	8*18	29	22
100	80	157	127	200	168,5	254	210	8*22	8*22	32	29
150	100	216	157	270	200	318	254	12*22	8*22	37	32
200	150	270	216	330	270	381	318	12*26	12*22	41	37

8.4 Pump dimensions

Pump type	aa	ab	db	ea	eb	ec	ed	mg	tb	va	vb	vd	ve	vf	vh	vi	vj	vk	vv	zb	zc	zd
CR 40A-125			140	50	8	27	24	100	0	320	270		60	20	100	314		160	190	100	411	300
CR 40A-160	50	40	140	50	8	27	24	100	0	350	300	18	60	20	100	314	50	160	190	100	411	320
CR 40A-200			160	50	8	27	24	100	0	400	350		60	25	100	314		160	190	100	411	360
CR 40A-250			180	80	10	35	32	100	0	450	400		60	25	100	378		160	190	125	509,5	405
CR 50A-125			140	50	8	27	24	100	0	330	280		50	20	100	314		160	190	100	411	300
CR 50A-160			140	50	8	27	24	100	0	350	300		60	20	100	314		160	190	100	411	320
CR 50A-200	80	50	160	50	8	27	24	100	0	400	350	18	60	25	100	314	50	160	190	100	411	350
CR 50A-250			180	80	10	35	32	100	0	450	400		50	25	100	378		160	190	125	509,5	430
CR 50A-315			200	80	10	35	32	120	0	520	470		60	30	120	378		190	230	125	509,5	480
CR 50B-125			140	50	8	27	24	100	0	350	300		50	20	100	314		160	190	100	411	300
CR 50B-160			160	50	8	27	24	100	0	380	330		50	20	100	314		160	190	100	411	360
CR 50B-200	80	50	160	50	8	27	24	100	0	400	350	18	50	25	100	314	50	160	190	125	411	385
CR 50B-250			180	80	10	35	32	100	0	450	400		50	25	100	378		160	190	125	509,5	430
CR 50B-315			225	80	10	35	32	120	0	520	470		60	30	120	378		190	230	125	509,5	505
CR 80A-125			160	50	8	27	24	120	0	420	355		60	25	120	314		160	190	100	411	340
CR 80A-160			160	80	10	35	32	120	0	440	375		60	25	120	378		160	190	100	509,5	360
CR 80A-200	100	80	180	80	10	35	32	120	0	480	415	22	60	25	120	378	65	160	190	100	509,5	405
CR 80A-250			200	80	10	35	32	120	0	520	455		60	25	120	378		190	230	125	509,5	450
CR 80A-315			225	110	12	45	42	120	0	545	480		60	30	120	385		190	230	125	551	505
CR 100A-160			180	80	10	35	32	120	0	520	455		60	25	120	378		160	190	125	509,5	405
CR 100A-200			180	80	10	35	32	120	0	520	455		60	25	120	378		160	190	125	509,5	430
CR 100A-250	150	100	225	80	10	35	32	120	0	550	485	22	70	25	120	378	65	190	230	125	509,5	505
CR 100A-315			250	110	12	45	42	120	0	600	535		60	30	120	385		190	230	140	551	565
CR 100A-400			280	110	12	45	42	120	0	700	635		60	30	120	385		190	230	140	551	635
CR 100B-200			200	80	10	35	32	120	0	580	515		60	25	120	378		190	230	140	509,5	480
CR 100B-250	150	100	225	110	12	45	42	120	0	600	535	22	60	25	120	385	65	190	230	140	551	505
CR 100B-315			250	110	12	45	42	120	0	620	535		60	30	120	385		190	230	140	551	565
CR 100B-400			280	110	12	45	42	120	0	700	620		60	30	120	385		190	230	140	551	695
CR 150A-250			250	110	12	45	42	140	0	680	600		70	25	140	385		190	230	140	551	605
CR 150A-315	200	150	280	110	12	45	42	140	0	700	620	22	70	30	140	385	80	190	230	140	551	635
CR 150A-400			315	110	12	45	42	140	0	750	670		70	30	140	385		190	230	140	551	715

9 Pump parts

9.1 Ordering parts and spare parts

You can use the order form included in this manual for ordering parts. You must always state the following on the order:

1 Your **address information**.
2 The **quantity**, the **item number** and the **description** of the part.
3 The **pump number**.

9.3 Cross section pump with closed impeller

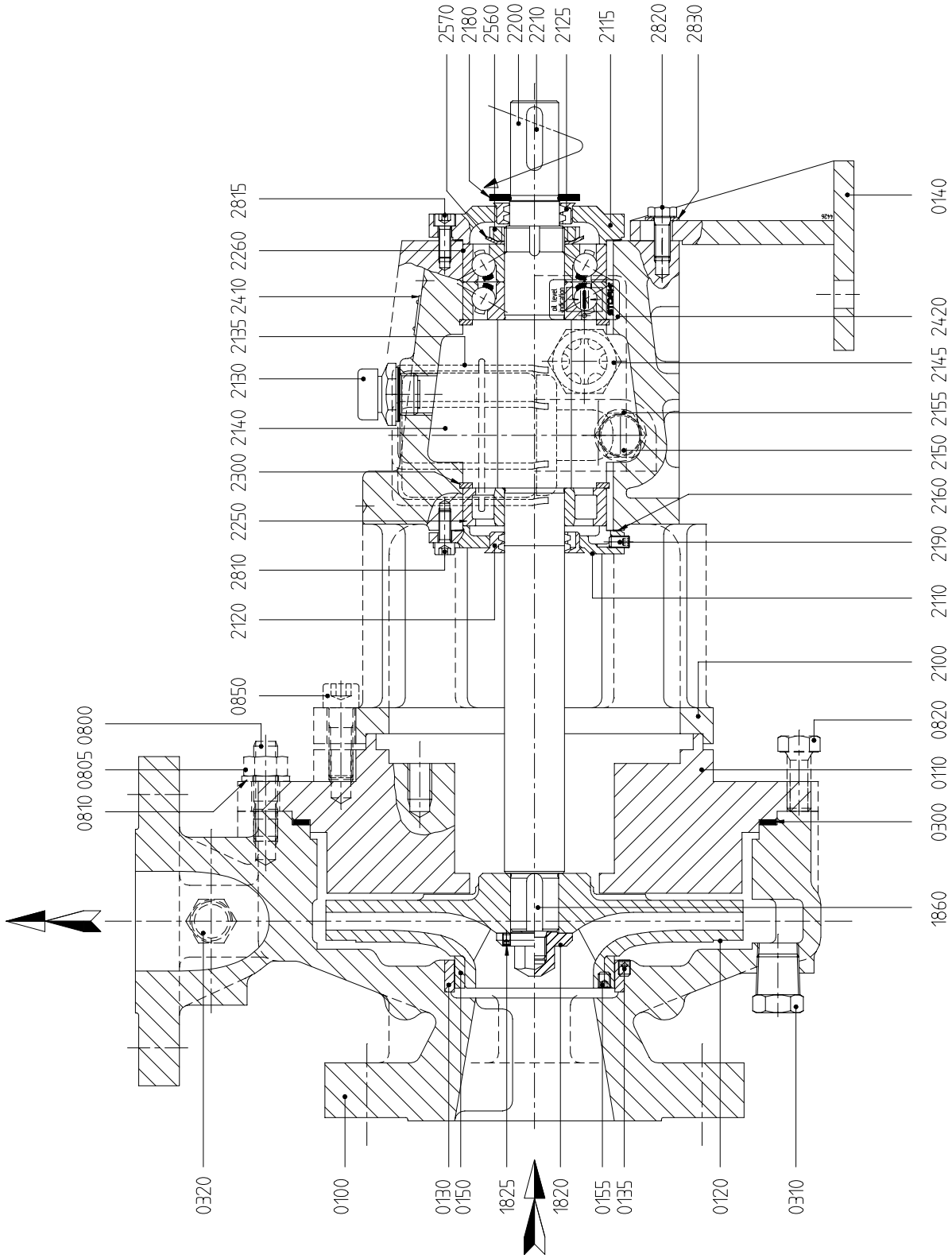
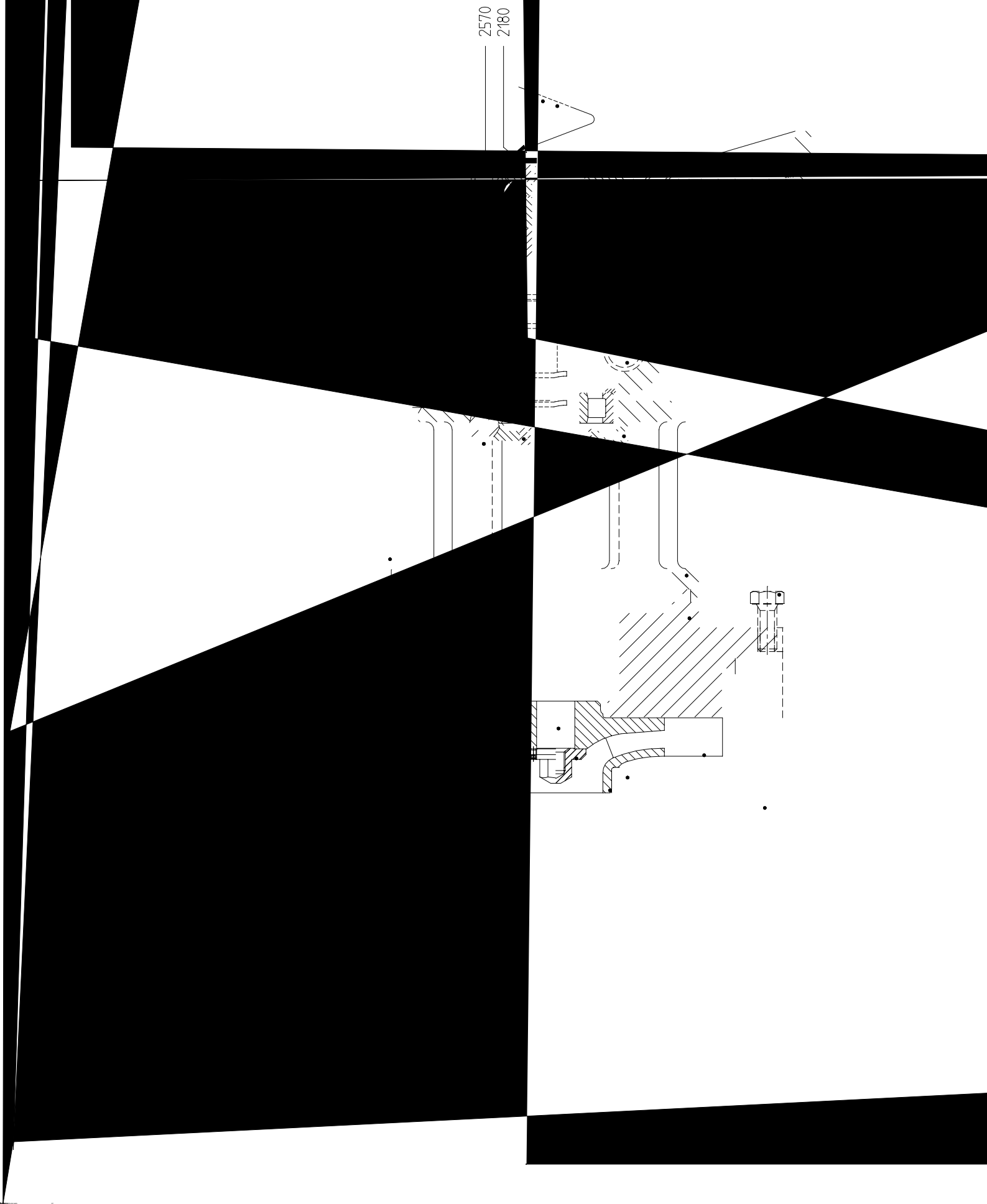


figure 12 Cross section CombiPro with closed impeller.

9.4 Cross section pump with semi-open impeller



9.5 Cross section pump with half open impeller

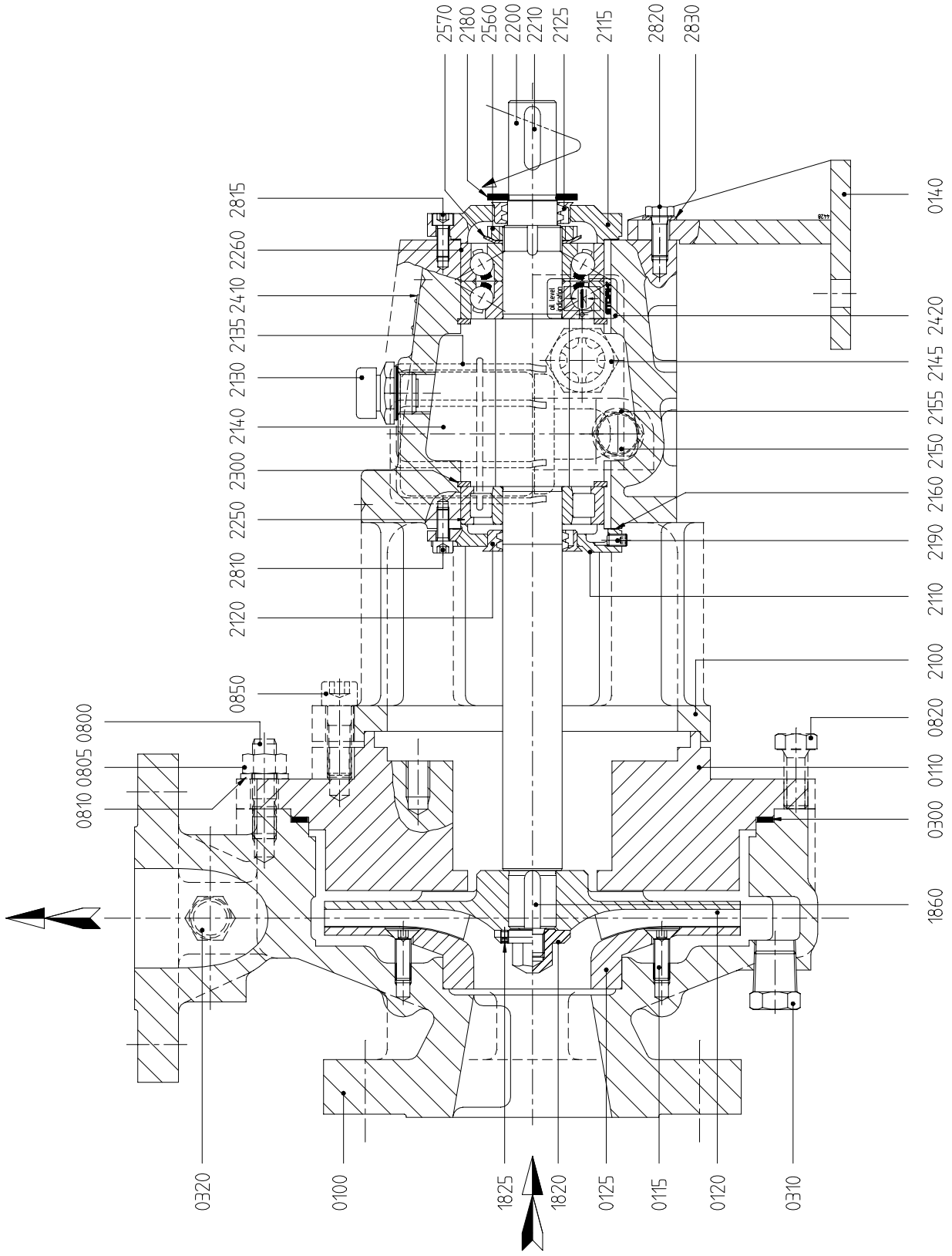


figure 14 Cross section CombiPro with half open impeller.

9.6 Cross section pump with cooling chamber

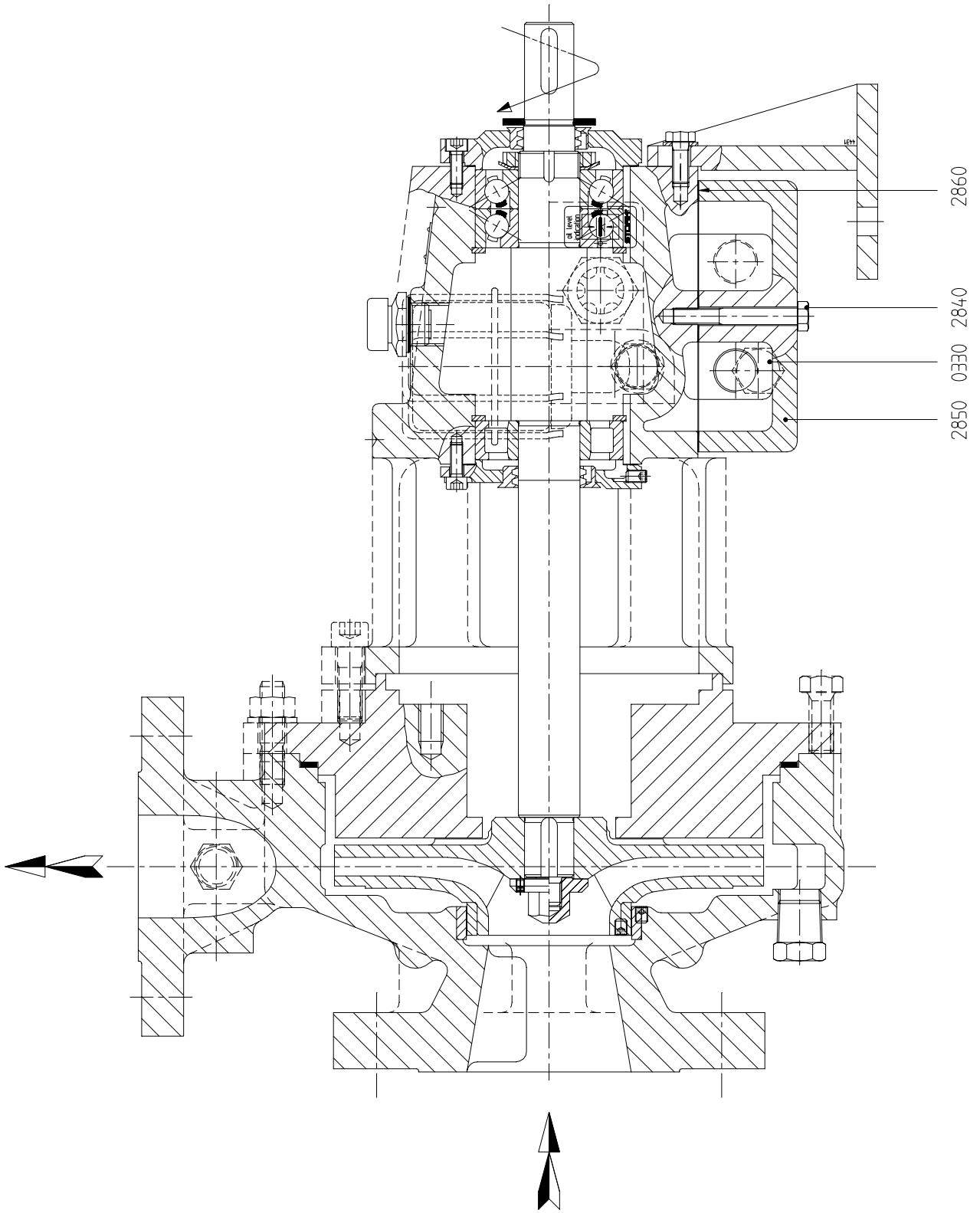


figure 15 Cross section CombiPro with cooling chamber.

9.7 Parts list pump S-1

figure 12	figure 13	figure 14	Nr	Description	Material code acc. API 610 code S-1	ASTM
0100			1	pump casing	carbon steel	A216 grade WCA
0110			1	pump cover	carbon steel	A216 grade WCA
- -		0115	**	countersunk head screw	stainless steel	A276 type 316
0120*			1	impeller	cast iron	A48 class 30
- -		0125	1	wear plate	cast iron	A48 class 30
0130*		- -	1	casing wear ring	Cr. Steel 200-250Br	A743 grade CA-40
0135			3	set screw	stainless steel	A276 type 304
0140			1	bracket support	steel	A108 grade 1020
0150*		- -	1	impeller wear ring	Cr. steel 300-350Br	A743 grade CA-40
0155			3	set screw	stainless steel	A276 type 304
0300*			1	gasket	- -	- -
0310			1	plug	steel	A108 grade 1020
0320			1	plug	steel	A108 grade 1020
0800			***	stud	Cr.Mo. steel	A193 grade B7
0805			***	nut	Cr.Mo. steel	A194 grade 2H
0810			***	lock washer	steel	- -
0820			2	bolt	stainless steel	A276 type 304
0850			****	allen screw	steel	A108 grade 1020
1820*			1	cap nut	stainless steel	A276 type 316
1825*			1	set screw	stainless steel	A276 type 304
1860*			1	impeller key	stainless steel	A276 type 316Ti
2100			1	bearing bracket	nodular cast iron	A395/536
2110			1	bearing cover	carbon steel	A48 class 35
2115			1	bearing cover	carbon steel	A48 class 35
2120*			1	oil baffle	bronze	B271 C93200
2125*			1	oil baffle	bronze	B271 C93200
2130			1	oil fill plug	steel	- -
2135			1	wire cage	steel	- -
2140			1	constant level oiler	- -	- -
2145			1	oil sight glass	- -	- -
2150			1	magnetic drain plug	steel	A108 grade 1020
2155			1	ring	gylon	- -
2160*			2	gasket bearing cover	- -	- -

figure 12	figure 13	figure 14	Nr	Description	Material code acc. API 610 code S-1	ASTM
2180			1	deflector	rubber	- -
2190			1	set screw	stainless steel	- -
2200*			1	pump shaft	Cr.Ni. steel	A276 type 431
2210*			1	coupling key	steel	A108 grade 1020
2250*			1	roller bearing	- -	- -
2260*			2	angular contact bearing	- -	- -
2300			2	inner circlip	steel	- -
2410			1	indication plate arrow	aluminium	- -
2420			1	indication plate oil level	stainless steel	- -
2560*			1	bearing lock nut	steel	- -
2570			1	retaining ring	steel	- -
2810			4	allen screw	steel	A108 grade 1020
2815			4	allen screw	steel	A108 grade 1020
2820*****			2	bolt	steel	A108 grade 1020
2830			2	washer	steel	- -

*) Recommended spare parts

**) Number depends on pump type: 2, 4, 6 or 8

***) Number depends on pump type: 8 or 12

****) Number depends on bearing group: 4 or 8

*****) Bearing group 1: Allen screw

9.8 Part slist pump S-6

figure 12	figure 13	figure 14	Nr	Description	Material code acc. API 610 code S-6	ASTM
0100			1	pump casing	carbon steel	A216 grade WCA
0110			1	pump cover	carbon steel	A216 grade WCA
- -		0115	**	countersunk head screw	stainless steel	A276 type 316
0120*			1	impeller	Cr. Steel	A296 grade CA-40
- -		0125	1	wear plate	Cr. Steel	A296 grade CA-40
0130*		- -	1	casing wear ring	Cr. Steel 200-250Br	A743 grade CA-40
0135			3	set screw	stainless steel	A276 type 304
0140			1	bracket support	steel	A108 grade 1020
0150*		- -	1	impeller wear ring	Cr. steel 300-350Br	A743 grade CA-40
0155			3	set screw	stainless steel	A276 type 304
0300*			1	gasket	- -	- -
0310			1	plug	steel	A108 grade 1020
0320			1	plug	steel	A108 grade 1020
0800			***	stud	Cr.Mo. steel	A193 grade B7
0805			***	nut	Cr.Mo. steel	A194 grade 2H
0810			***	lock washer	steel	- -
0820			2	bolt	stainless steel	A276 type 304
0850			****	allen screw	steel	A108 grade 1020
1820*			1	cap nut	stainless steel	A276 type 316
1825*			1	set screw	stainless steel	A276 type 304
1860*			1	impeller key	stainless steel	A276 type 316Ti
2100			1	bearing bracket	nodular cast iron	A395/536
2110			1	bearing cover	carbon steel	A48 class 35
2115			1	bearing cover	carbon steel	A48 class 35
2120*			1	oil baffle	bronze	B271 C93200
2125*			1	oil baffle	bronze	B271 C93200
2130			1	oil fill plug	steel	- -
2135			1	wire cage	steel	- -
2140			1	constant level oiler	- -	- -
2145			1	oil sight glass	- -	- -
2150			1	magnetic drain plug	steel	A108 grade 1020
2155			1	ring	gylon	- -
2160*			2	gasket bearing cover	- -	- -

figure 12	figure 13	figure 14	Nr	Description	Material code acc. API 610 code S-6	ASTM
2180			1	deflector	rubber	- -
2190			1	set screw	stainless steel	- -
2200*			1	pump shaft	Cr.Ni. steel	A276 type 431
2210*			1	coupling key	steel	A108 grade 1020
2250*			1	roller bearing	- -	- -
2260*			2	angular contact bearing	- -	- -
2300			2	inner circlip	steel	- -
2410			1	indication plate arrow	aluminium	- -
2420			1	indication plate oil level	stainless steel	- -
2560*			1	bearing lock nut	steel	- -
2570			1	retaining ring	steel	- -
2810			4	allen screw	steel	A108 grade 1020
2815			4	allen screw	steel	A108 grade 1020
2820*****			2	bolt	steel	A108 grade 1020
2830			2	washer	steel	- -

*) Recommended spare parts

**) Number depends on pump type: 2, 4, 6 or 8

***) Number depends on pump type: 8 or 12

****) Number depends on bearing group: 4 or 8

*****) Bearing group 1: Allen screw

9.9 Parts list pump S-8

figure 12	figure 13	figure 14	Nr	Description	Material code acc. API 610 code S-8	ASTM
0100			1	pump casing	carbon steel	A216 grade WCA
0110			1	pump cover	carbon steel	A216 grade WCA
- -		0115	**	countersunk head screw	stainless steel	A276 type 316
0120*			1	impeller	stainless steel	A296 grade CC50
- -		0125	1	wear plate	stainless steel	A296 grade CC50
0130*		- -	1	casing wear ring	stainless steel	A351 grade CF-8M
0135			3	set screw	stainless steel	A276 type 304
0140			1	bracket support	steel	A108 grade 1020
0150*		- -	1	impeller wear ring	stainless steel	A351 grade CF-8M
0155			3	set screw	stainless steel	A276 type 304
0300*			1	gasket	- -	- -
0310			1	plug	steel	A108 grade 1020
0320			1	plug	steel	A108 grade 1020
0800			***	stud	Cr.Mo. steel	A193 grade B7
0805			***	nut	Cr.Mo. steel	A194 grade H2
0810			***	lock washer	steel	- -
0820			2	bolt	stainless steel	A276 type 304
0850			****	allen screw	steel	A108 grade 1020
1820*			1	cap nut	stainless steel	A276 type 316
1825*			1	set screw	stainless steel	A276 type 304
1860*			1	impeller key	stainless steel	A276 type 316Ti
2100			1	bearing bracket	nodular cast iron	A395/536
2110			1	bearing cover	carbon steel	A48 class 35
2115			1	bearing cover	carbon steel	A48 class 35
2120*			1	oil baffle	bronze	B271 C93200
2125*			1	oil baffle	bronze	B271 C93200
2130			1	oil fill plug	steel	- -
2135			1	wire cage	steel	- -
2140			1	constant level oiler	- -	- -
2145			1	oil sight glass	- -	- -
2150			1	magnetic drain plug	steel	A108 grade 1020
2155			1	ring	gylon	- -
2160*			2	gasket bearing cover	- -	- -

figure 12	figure 13	figure 14	Nr	Description	Material code acc. API 610 code S-8	ASTM
2180			1	deflector	rubber	- -
2190			1	set screw	stainless steel	- -
2200*			1	pump shaft	stainless steel	A276 type 316L
2210*			1	coupling key	steel	A108 grade 1020
2250*			1	roller bearing	- -	- -
2260*			2	angular contact bearing	- -	- -
2300			2	inner circlip	steel	- -
2410			1	indication plate arrow	aluminium	- -
2420			1	indication plate oil level	stainless steel	- -
2560*			1	bearing lock nut	steel	- -
2570			1	retaining ring	steel	- -
2810			4	allen screw	steel	A108 grade 1020
2815			4	allen screw	steel	A108 grade 1020
2820*****			2	bolt	steel	A108 grade 1020
2830			2	washer	steel	- -

*) Recommended spare parts

**) Number depends on pump type: 2, 4, 6 or 8

***) Number depends on pump type: 8 or 12

****) Number depends on bearing group: 4 or 8

*****) Bearing group 1: Allen screw

9.10 Parts list pump C-6

figure 12	figure 13	figure 14	Nr	Description	Material code acc. API 610 code C-6	ASTM
0100			1	pump casing	Cr. steel	A296 grade CA-40
0110			1	pump cover	Cr. steel	A296 grade CA-40
- -		0115	**	countersunk head screw	stainless steel	A276 type 316
0120*			1	impeller	Cr. steel	A296 grade CA-40
- -		0125	1	wear plate	Cr. steel	A296 grade CA-40
0130*		- -	1	casing wear ring	Cr. Steel 200-250Br	A743 grade CA-40
0135			3	set screw	stainless steel	A276 type 304
0140			1	bracket support	steel	A108 grade 1020
0150*		- -	1	impeller wear ring	Cr. steel 300-350Br	A743 grade CA-40
0155			3	set screw	stainless steel	A276 type 304
0300*			1	gasket	- -	- -
0310			1	plug	steel	A108 grade 1020
0320			1	plug	steel	A108 grade 1020
0800			***	stud	Cr.Mo. steel	A193 grade B7
0805			***	nut	Cr.Mo. steel	A194 grade 2H
0810			***	lock washer	steel	- -
0820			2	bolt	stainless steel	A276 type 304
0850			****	allen screw	steel	A108 grade 1020
1820*			1	cap nut	stainless steel	A276 type 316
1825*			1	set screw	stainless steel	A276 type 304
1860*			1	impeller key	stainless steel	A276 type 316Ti
2100			1	bearing bracket	nodular cast iron	A395/536
2110			1	bearing cover	carbon steel	A48 class 35
2115			1	bearing cover	carbon steel	A48 class 35
2120*			1	oil baffle	bronze	B271 C93200
2125*			1	oil baffle	bronze	B271 C93200
2130			1	oil fill plug	steel	- -
2135			1	wire cage	steel	- -
2140			1	constant level oiler	- -	- -
2145			1	oil sight glass	- -	- -
2150			1	magnetic drain plug	steel	A108 grade 1020
2155			1	ring	gylon	- -
2160*			2	gasket bearing cover	- -	- -

figure 12	figure 13	figure 14	Nr	Description	Material code acc. API 610 code C-6	ASTM
2180			1	deflector	rubber	- -
2190			1	set screw	stainless steel	- -
2200*			1	pump shaft	Cr.Ni. steel	A276 type 431
2210*			1	coupling key	steel	A108 grade 1020
2250*			1	roller bearing	- -	- -
2260*			2	angular contact bearing	- -	- -
2300			2	inner circlip	steel	- -
2410			1	indication plate arrow	aluminium	- -
2420			1	indication plate oil level	stainless steel	- -
2560*			1	bearing lock nut	steel	- -
2570			1	retaining ring	steel	- -
2810			4	allen screw	steel	A108 grade 1020
2815			4	allen screw	steel	A108 grade 1020
2820*****			2	bolt	steel	A108 grade 1020
2830			2	washer	steel	- -

*) Recommended spare parts

**) Number depends on pump type: 2, 4, 6 or 8

***) Number depends on pump type: 8 or 12

****) Number depends on bearing group: 4 or 8

*****) Bearing group 1: Allen screw

9.11 Parts list pump A-8

figure 12	figure 13	figure 14	Nr	Description	Material code acc. API 610 code A-8	ASTM
0100			1	pump casing	stainless steel	A351 grade CF-8M
0110			1	pump cover	stainless steel	A351 grade CF-8M
- -		0115	**	countersunk head screw	stainless steel	A276 type 316
0120*			1	impeller	stainless steel	A296 grade CC50
- -		0125	1	wear plate	stainless steel	A296 grade CC50
0130*		- -	1	casing wear ring	stainless steel	A351 grade CF-8M
0135			3	set screw	stainless steel	A276 type 304
0140			1	bracket support	steel	A108 grade 1020
0150*		- -	1	impeller wear ring	stainless steel	A296 grade CC50
0155			3	set screw	stainless steel	A276 type 304
0300*			1	gasket	- -	- -
0310			1	plug	stainless steel	A276 type 316
0320			1	plug	stainless steel	A276 type 316
0800			***	stud	Cr.Mo. steel	A193 grade B7
0805			***	nut	Cr.Mo. steel	A194 grade 2H
0810			***	lock washer	steel	- -
0820			2	bolt	stainless steel	A276 type 304
0850			****	allen screw	steel	A108 grade 1020
1820*			1	cap nut	stainless steel	A276 type 316
1825*			1	set screw	stainless steel	A276 type 304
1860*			1	impeller key	stainless steel	A276 type 316Ti
2100			1	bearing bracket	nodular cast iron	A395/536
2110			1	bearing cover	carbon steel	A48 class 35
2115			1	bearing cover	carbon steel	A48 class 35
2120*			1	oil baffle	bronze	B271 C93200
2125*			1	oil baffle	bronze	B271 C93200
2130			1	oil fill plug	steel	- -
2135			1	wire cage	steel	- -
2140			1	constant level oiler	- -	- -
2145			1	oil sight glass	- -	- -
2150			1	magnetic drain plug	steel	A108 grade 1020
2155			1	ring	gylon	- -
2160*			2	gasket bearing cover	- -	- -

figure 12	figure 13	figure 14	Nr	Description	Material code acc. API 610 code A-8	ASTM
2180			1	deflector	rubber	- -
2190			1	set screw	stainless steel	- -
2200*			1	pump shaft	stainless steel	A276 type 316L
2210*			1	coupling key	steel	A108 grade 1020
2250*			1	roller bearing	- -	- -
2260*			2	angular contact bearing	- -	- -
2300			2	inner circlip	steel	- -
2410			1	indication plate arrow	aluminium	- -
2420			1	indication plate oil level	stainless steel	- -
2560*			1	bearing lock nut	steel	- -
2570			1	retaining ring	steel	- -
2810			4	allen screw	steel	A108 grade 1020
2815			4	allen screw	steel	A108 grade 1020
2820*****			2	bolt	steel	A108 grade 1020
2830			2	washer	steel	- -

*) Recommended spare parts

**) Number depends on pump type 2, 4, 6 or 8

***) Number depends on pump type 8 or 12

****) Number depends on bearing group 4 or 8

*****) Bearing group 1: Allen screw

9.12 Partslist cooling chamber

See figure 15.

Item nr.	Number	Description	Material code acc. API 610	ASTM
0330	1	plug	steel	A108 grade 1020
2840	6	bolt	steel	A108 grade 1020
2850	1	heating/cooling reservoir	nodular cast iron	A395/536
2860	1	gasket	- -	- -

10 Technical data

10.1 Recommended liquid locking agents

Part	Locking agent
casing wear ring (0130)	Loctite 641
impeller wear ring (0150)	Loctite 641

10.2 Torques settings

10.2.1 Torques settings for bolts and nuts

! For nuts for pump casing (itemnr 0805), see 10.2.3!

Screw thread	Torque [Nm]	
Material:	**8.8**	**A2, A4**
M6	8,3	5,8
M8	20	14,09
M10	40	25
M12	68,8	43
M16	167,3	104,6

10.2.2 Torques settings for impeller nut

Size	Torque [Nm]
M12	43
M16	104
M24	220

10.2.3 Torques settings for nuts for pump casing

Torques settings for nuts for pump casing (item nr 0805)

Pump type	Shaft group	Bolt circle [mm]	Bolts	F_{bolt} [N]	M_a greased [N/mm^2]	M_a non-greased [N/mm^2]	Washer
CR 40A-125	1	200	8x M10	30197	44	55	21x10,5x2
CR 40A-160	1	223,5	8x M12	43110	74	86	24x13x2,5
CR 40A-200	1	269,5	8x M12	43110	74	86	24x13x2,5
CR 40A-250	2	315,5	12x M12	43025	74	86	24x13x2,5
CR 50A-125	1	200	8x M10	30197	44	55	21x10,5x2
CR 50A-160	1	223,5	8x M12	43110	74	86	24x13x2,5
CR 50A-200	1	269,5	8x M12	43110	74	86	24x13x2,5
CR 50A-250	2	315,5	12x M12	43025	74	86	24x13x2,5
CR 50A-315	2	379,5	8x M16	81048	180	210	30x17x3
CR 50B-125	1	200	8x M10	30197	44	55	21x10,5x2
CR 50B-160	1	223,5	8x M12	43110	74	86	24x13x2,5
CR 50B-200	1	269,5	8x M12	43110	74	86	24x13x2,5
CR 50B-250	2	315,5	12x M12	43025	74	86	24x13x2,5
CR 50B-315	2	379,5	8x M16	81048	180	210	30x17x3
CR 80A-125	1	200	8x M10	30197	44	55	21x10,5x2
CR 80A-160	2	269,5	8x M12	43110	74	86	24x13x2,5
CR 80A-200	2	269,5	8x M12	44383	76	89	24x13x2,5
CR 80A-250	2	315,5	12x M12	43025	74	86	24x13x2,5
CR 80A-315	3	379,5	8x M16	81048	180	210	30x17x3
CR 100A-160	2	269,5	8x M12	43110	74	86	24x13x2,5
CR 100A-200	2	269,5	8x M12	44383	76	89	24x13x2,5
CR 100A-250	2	315,5	12x M12	43025	74	86	24x13x2,5
CR 100A-315	3	379,5	8x M16	81048	180	210	30x17x3
CR 100A-400	3	473,5	12x M16	81299	181	210	30x17x3
CR 100B-200	2	269,5	8x M12	44383	76	89	24x13x2,5
CR 100B-250	3	315,5	12x M12	43025	74	86	24x13x2,5
CR 100B-315	3	379,5	8x M16	81048	180	210	30x17x3
CR 100B-400	3	473,5	12x M16	81299	181	210	30x17x3
CR 150A-250	3	315,5	12x M12	43025	74	86	24x13x2,5
CR 150A-315	3	379,5	8x M16	81048	180	210	30x17x3
CR 150A-400	3	473,5	12x M16	81299	181	210	30x17x3

10.3 Masses and cubic contents

Pump type	Nett.mass pump in kg	Motor IEC IP54																
		80	90 S	90 L	100 L	112 M	132 S	132 M	160 M	160 L	180 M	180 L	200 L	225 S	225 M	250 M	280 S	280 M
		20	23	27	38	45	70	81	125	147	180	195	270	284	320	427	562	667
		Nett/Gross masses in kg and cubic contents in m^3 of pump with motor,excl. sealpiping and baseplate (based on motor make: Dutchi)																
CR 40A-125	52	75	78	82	93	100	125											
		0,16	0,17	0,17	0,19	0,22	0,25											
CR 40A-160	60	83	86	90	101	108	133											
		0,17	0,18	0,18	0,20	0,23	0,26											
CR 40A-200	70	93	96	100	111	118	143		200									
		0,21	0,22	0,22	0,24	0,25	0,28		0,35									
CR 40A-250	118	143	144	148	159	166	191		248	270	303		397					
		0,30	0,17	0,17	0,19	0,33	0,35		0,44	0,45	0,49		0,61					
CR 50A-125	59	82	85	89	100	107	132											
		0,16	0,17	0,17	0,19	0,22	0,25											
CR 50A-160	66	90	93	97	108	115	140		197									
		0,17	0,18	0,18	0,20	0,23	0,26		0,34									
CR 50A-200	78	102	105	109	120	127	152		208									
		0,21	0,22	0,22	0,23	0,25	0,28		0,35									
CR 50A-250	122	145	148	152	163	170	195		252	274	307		401					
		0,31	0,31	0,33	0,34	0,34	0,37		0,46	0,47	0,51		0,63					
CR 50A-315	130		156	160	171	178	203		260	282	315		409		459	562	697	
			0,39	0,41	0,42	0,42	0,46		0,52	0,54	0,55		0,66		0,76	0,94	1,09	
CR 50B-125	58	82	85	89	100	107	132		189									
		0,17	0,17	0,17	0,19	0,22	0,25		0,33									
CR 50B-160	64	87	90	94	105	112	137		194									
		0,20	0,21	0,21	0,22	0,25	0,28		0,35									
CR 50B-200	79	102	105	109	120	127	152		209	231	264		358					
		0,24	0,24	0,25	0,26	0,26	0,31		0,37	0,39	0,43		0,57					
CR 50B-250	101	125	128	132	143	150	175		232	254	287		380		430			
		0,31	0,31	0,33	0,34	0,34	0,37		0,46	0,47	0,51		0,63		0,72			
CR 50B-315	138			168	179	186	211	222	268	290	323		417		467	570	705	
				0,42	0,44	0,44	0,48	0,48	0,54	0,56	0,57		0,69		0,76	0,94	1,09	
CR 80A-125	67	91	94	98	109	116	141		198									
		0,20	0,21	0,21	0,22	0,24	0,27		0,37									
CR 80A-160	105	129	132	136	147	154	179		235		290		384					
		0,24	0,25	0,25	0,26	0,27	0,31		0,38		0,43		0,57					
CR 80A-200	111	134	137	141	152	159	184		241	263	296		390					
		0,30	0,31	0,31	0,33	0,33	0,35		0,41	0,43	0,46		0,61					

Pump type	Nett.mass pump in kg	Motor IEC IP54																
		80	90 S	90 L	100 L	112 M	132 S	132 M	160 M	160 L	180 M	180 L	200 L	225 S	225 M	250 M	280 S	280 M
		20	23	27	38	45	70	81	125	147	180	195	270	284	320	427	562	667
		Nett/Gross masses in kg and cubic contents in m^3 of pump with motor,excl. sealpiping and baseplate (based on motor make: Dutchi)																
CR 80A-250	140		166	170	181	188	213		270	292	325	344	419		469			
			0,38	0,40	0,40	0,41	0,43		0,50	0,52	0,55	0,56	0,65		0,77			
CR 80A-315	180			212	223	230	255	266	310	332	365		459		509	612	747	852
				0,45	0,45	0,47	0,49	0,51	0,57	0,59	0,59		0,71		0,80	0,96	1,15	1,18
CR 100A-160	131		157	161	172	179	204		261	283	316		410					
			0,34	0,35	0,37	0,37	0,38		0,43	0,44	0,46		0,61					
CR 100A-200	140		167	171	182	189	214	225	271	293	326		420		470	573	708	
			0,35	0,37	0,38	0,38	0,40	0,41	0,45	0,49	0,51		0,63		0,74	0,93	1,08	
CR 100A-250	160		187	191	202	209	234	245	291	313	346		439		489	593	728	
			0,42	0,44	0,46	0,46	0,48	0,49	0,56	0,57	0,57		0,69		0,78	0,96	1,12	
CR 100A-315	207				251	258	283	294	338	360	393	411	486		536	640	775	880
					0,57	0,57	0,61	0,61	0,68	0,70	0,73	0,73	0,80		0,87	1,04	1,20	1,23
CR 100A-400	265						340	351	395	417	450	469	547	561				
							0,82	0,82	0,87	0,90	0,93	0,93	1,02	1,05				
CR 100B-200	135				179	186	211	222	266	288	321		414		464	568	703	
					0,47	0,47	0,50	0,52	0,56	0,58	0,60		0,68		0,78	0,96	1,12	
CR 100B-250	178				222	229	254	265	309	331	364		458		508	611	746	
					0,52	0,52	0,56	0,56	0,63	0,65	0,67		0,74		0,80	0,99	1,15	
CR 100B-315	204					255	280	291	335	357	390	408	483	500	536	637	772	877
						0,61	0,66	0,66	0,71	0,73	0,75	0,78	0,83	0,87	0,87	1,04	1,20	1,23
CR 100B-400	272						347	358	402	424	457	476	554	568	604	704		
							0,82	0,82	0,87	0,90	0,93	0,97	1,02	1,05	1,05	1,15		
CR 150A-250	221				264	271	296	307	351	373	406	425	500		550	653	788	
					0,68	0,68	0,73	0,73	0,78	0,80	0,83	0,86	0,92		0,94	1,09	1,26	
CR 150A-315	246						322	333	377	399	432	451	526	543	579	679		
							0,82	0,78	0,83	0,86	0,89	0,92	0,98	1,01	1,01	1,13		
CR 150A-400	308							394	438	460	493	512	590	604	640	740	879	
								0,96	1,02	1,06	1,09	1,09	1,15	1,19	1,19	1,30	1,38	

10.4 Recommanded oil

Recommanded oil types for ambient temperatures over 15 °C according to classification ISO VG 68:

BP	HLP 68
Gulf	Texaco
Chevron	EP Industrial Oil 68
Total	Azolla 68
Esso	Teresso 68
Shell	Tellus 68
Mobil	Mobil DTE oil heavy medium

10.5 Quantity of oil for bearing

CombiPro	Quantity of oil [dm^3]
CR 40A-125	0,4
CR 40A-160	0,4
CR 40A-200	0,4
CR 40A-250	0,5
CR 50A-125	0,4
CR 50A-160	0,4
CR 50A-200	0,4
CR 50A-250	0,5
CR 50A-315	0,5
CR 50B-125	0,4
CR 50B-160	0,4
CR 50B-200	0,4
CR 50B-250	0,5
CR 50B-315	0,5
CR 80A-125	0,4
CR 80A-160	0,5
CR 80A-200	0,5
CR 80A-250	0,5
CR 80A-315	0,6
CR 100A-160	0,5
CR 100A-200	0,5
CR 100A-250	0,5
CR 100A-315	0,6
CR 100A-400	0,6
CR 100B-200	0,5
CR 100B-250	0,6
CR 100B-315	0,6
CR 100B-400	0,6
CR 150A-250	0,6
CR 150A-315	0,6
CR 150A-400	0,6

10.6 Permissible pressure and temperature

CombiPro	Maximum speed (at max.impeller diameter) [min^{-1}]	Maximum allowable working pressure (to 50°C) [10^2 kPa]		Maximum hydrostatic test pressure (to 50°C) [10^2 kPa]	
		carbon steel*)	st.st.*)	carbon steel*)	st.st.*)
CR 40A-125	3600	35	32	53	48
CR 40A-160	3600	35	32	53	48
CR 40A-200	3600	30	30	45	45
CR 40A-250	3600	32	26	48	40
CR 50A-125	3600	35	28	53	42
CR 50A-160	3600	35	26	53	40
CR 50A-200	3600	30	28	45	42
CR 50A-250	3600	31	24	47	36
CR 50A-315	3000	25	20	38	30
CR 50B-125	3600	29	22	44	33
CR 50B-160	3600	26	20	39	30
CR 50B-200	3600	30	22	45	33
CR 50B-250	3600	32	24	48	36
CR 50B-315	3000	26	20	40	30
CR 80A-125	3000 1)	25	20	38	30
CR 80A-160	3600	25	20	38	30
CR 80A-200	3600	27	21	41	32
CR 80A-250	3600	26	20	39	30
CR 80A-315	3000	30	22	45	33
CR 100A-160	3000 1)	25	20	38	30
CR 100A-200	1800 1)	25	20	38	30
CR 100A-250	1800 1)	30	22	45	33
CR 100A-315	3000	26	20	40	30
CR 100A-400	1800	25	20	38	30
CR 100B-200	1800 1)	25	20	38	30
CR 100B-250	3000	25	20	38	30
CR 100B-315	1800 1)	26	20	39	30
CR 100B-400	1800	30	22	45	33
CR 150A-250	1800	25	20	38	30
CR 150A-315	1800	28	21	42	32
CR 150A-400	1500 1)	30	23	45	35

1): See 10.7

*)	150°C	250°C	350°C
carbon steel	90%	80%	70%
stainless steel	80%	70%	65%

10.7 Eventual higher maximum speed

Eventual higher maximum speed as mentioned in 10.6, with reduced impeller diameter:

CR	Max. speed [min-1]/impeller diameter [mm]				
	Dmax	1500	1800	3000	3600
CR 80A-125	142			142	128
CR 100A-160	179			179	171
CR 100A-200	214		214	201	181
CR 100A-250	260		260	258	
CR 100B-200	220		220	202	
CR 100B-315	324		324	311	
CR 150A-400	404	404	401		

10.8 Allowable forces and moments on the flanges

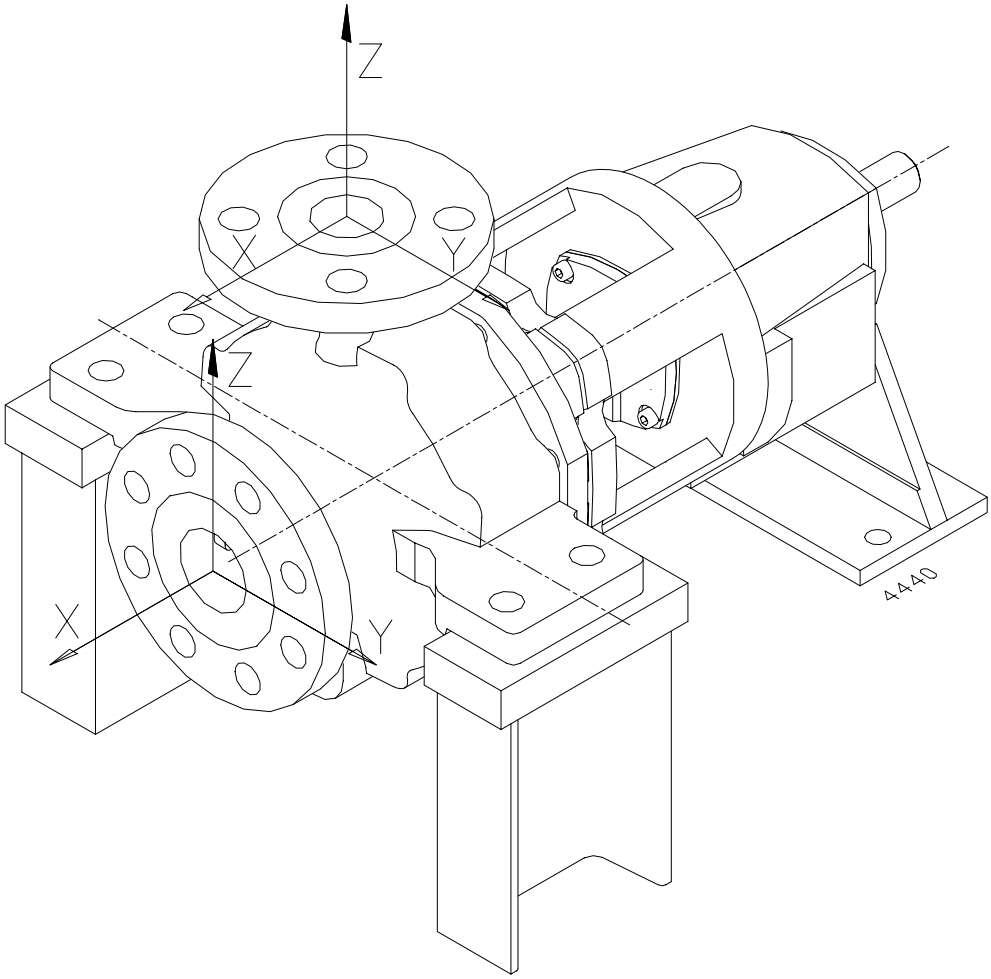


figure 16: Coordinate system according to API 610 - 2.4.1.

10.8.1 Allowable forces and moments on the suction flange

Allowable forces and moments on the suction flange, based on API 610 - 2.4.1

Pump type	Allowable forces [N]				Allowable moments [Nm]			
	Suction				Suction			
	Fx	Fy	Fz	Fr	Mx	My	Mz	Mr
CR 40A-125	890	710	580	1280	460	230	350	620
CR 40A-160								
CR 40A-200								
CR 40A-250								
CR 50A-125	1330	1070	890	1930	950	470	720	1280
CR 50A-160								
CR 50A-200								
CR 50A-250								
CR 50A-315								
CR 50B-125	1330	1070	890	1930	950	470	720	1280
CR 50B-160								
CR 50B-200								
CR 50B-250								
CR 50B-315								
CR 80A-125	1780	1420	1160	2560	1330	680	1000	1800
CR 80A-160								
CR 80A-200								
CR 80A-250								
CR 80A-315								
CR 100A-160	3110	2490	2050	4480	2300	1180	1760	3130
CR 100A-200								
CR 100A-250								
CR 100A-315								
CR 100A-400								
CR 100B-200	3110	2490	2050	4480	2300	1180	1760	3130
CR 100B-250								
CR 100B-315								
CR 100B-400								
CR 150A-250	4890	3780	3110	6920	3530	1760	2580	4710
CR 150A-315								
CR 150A-400								

Pump mounted on a grouted baseplate of carbon steel
Fr, Mr = resultant

10.8.2 Allowable forces and moments on the discharge flange

Allowable forces and moments on the discharge flange, based on API 610 - 2.4.1

Pump type	Allowable forces [N]				Allowable moments [Nm]			
	Discharge				Discharge			
	Fx	Fy	Fz	Fr	Mx	My	Mz	Mr
CR 40A-125	710	580	890	1280	460	230	350	620
CR 40A-160								
CR 40A-200								
CR 40A-250								
CR 50A-125	710	580	890	1280	460	230	350	620
CR 50A-160								
CR 50A-200								
CR 50A-250								
CR 50A-315								
CR 50B-125	710	580	890	1280	460	230	350	620
CR 50B-160								
CR 50B-200								
CR 50B-250								
CR 50B-315								
CR 80A-125	1070	890	1330	1930	950	470	720	1280
CR 80A-160								
CR 80A-200								
CR 80A-250								
CR 80A-315								
CR 100A-160	1420	1160	1780	2560	1330	680	1000	1800
CR 100A-200								
CR 100A-250								
CR 100A-315								
CR 100A-400								
CR 100B-200	1420	1160	1780	2560	1330	680	1000	1800
CR 100B-250								
CR 100B-315								
CR 100B-400								
CR 150A-250	2490	2050	3110	4480	2300	1180	1760	3130
CR 150A-315								
CR 150A-400								

Pump mounted on a grouted baseplate of carbon steel
Fr, Mr = resultant

10.9 Survey curves

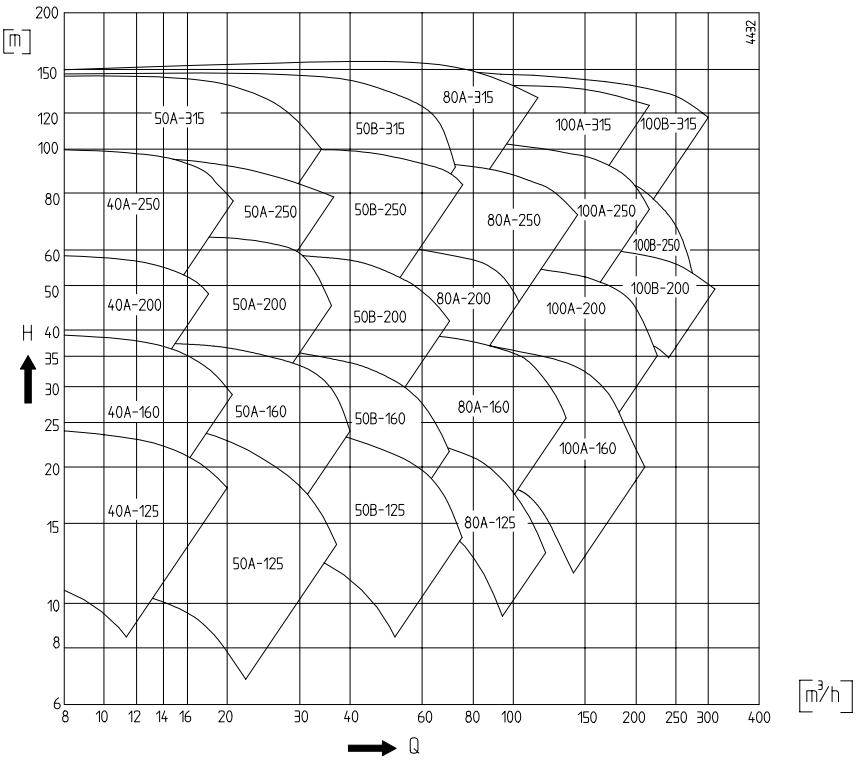


figure 17: Survey curve for cast steel pump at 3000 min^{-1}.

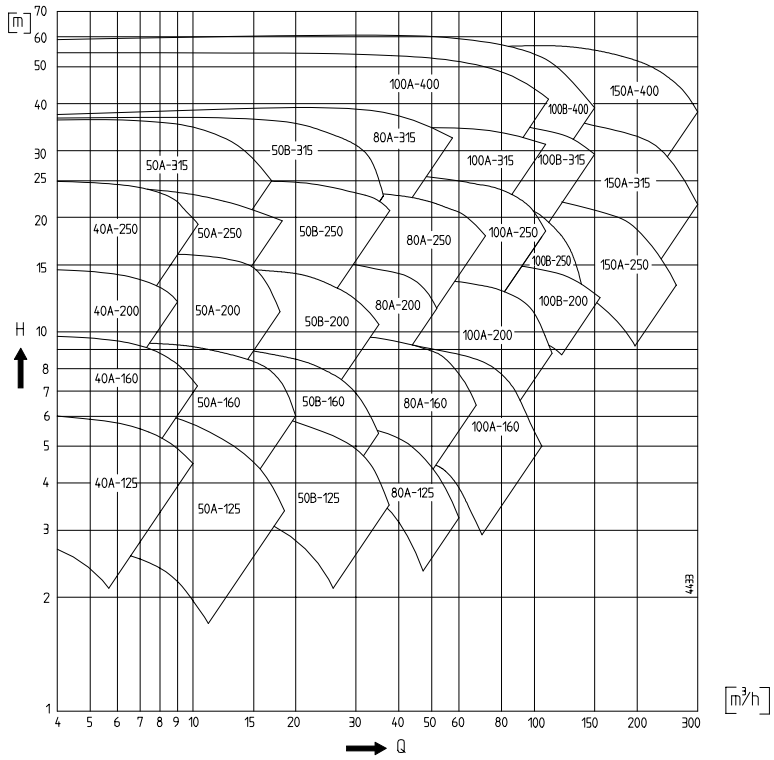


figure 18: Survey curve for cast steel pump at 1500 min^{-1}.

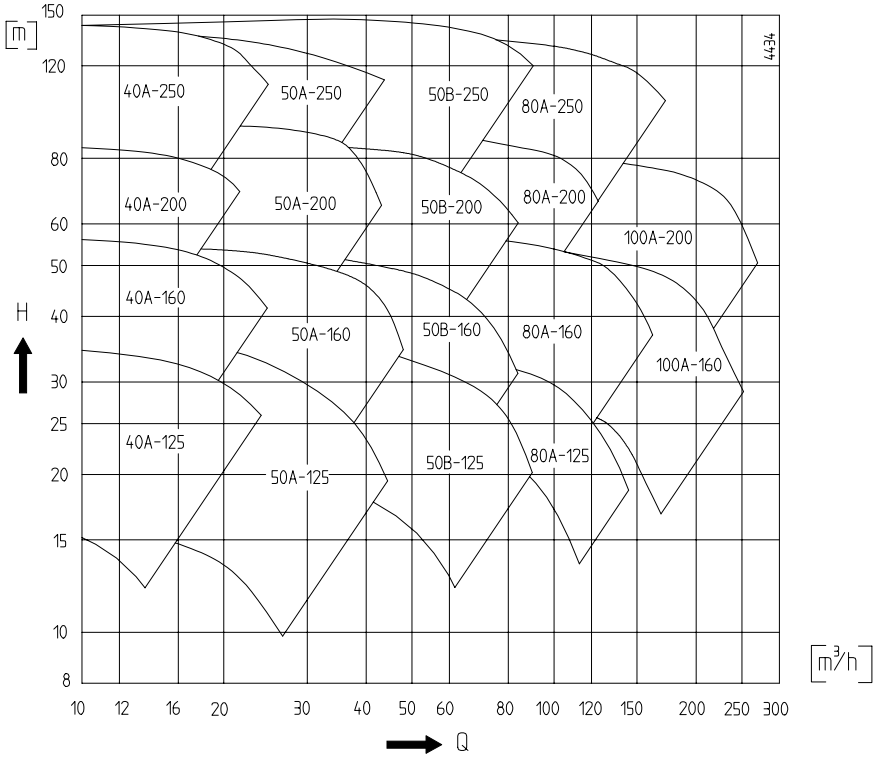


figure 19: Survey curve for cast steel pump at 3600 min^{-1}.

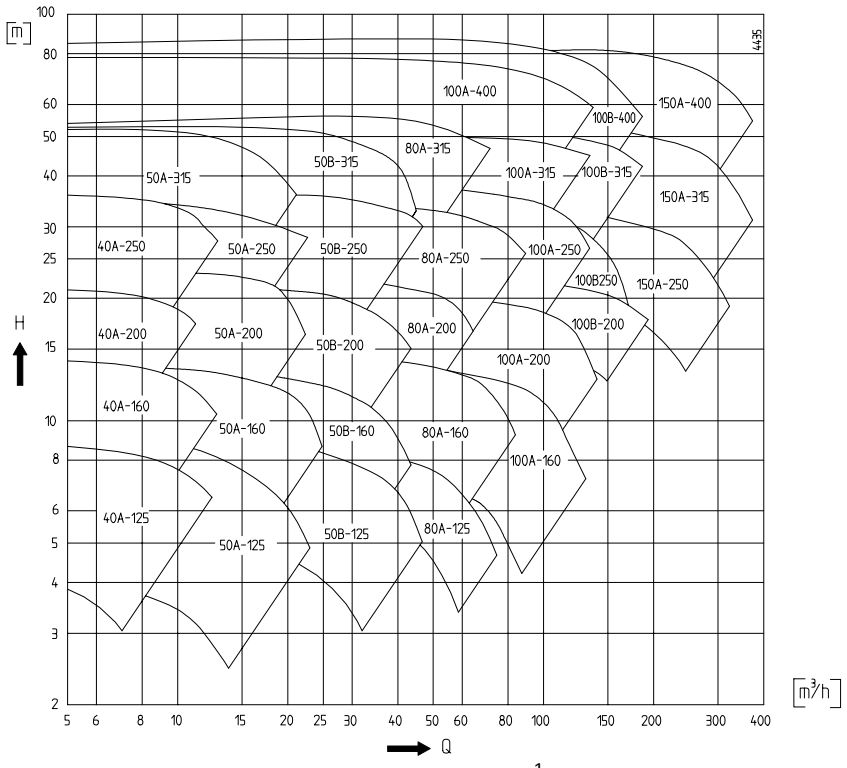


figure 20: Survey curve for cast steel pump at 1800 min^{-1}.

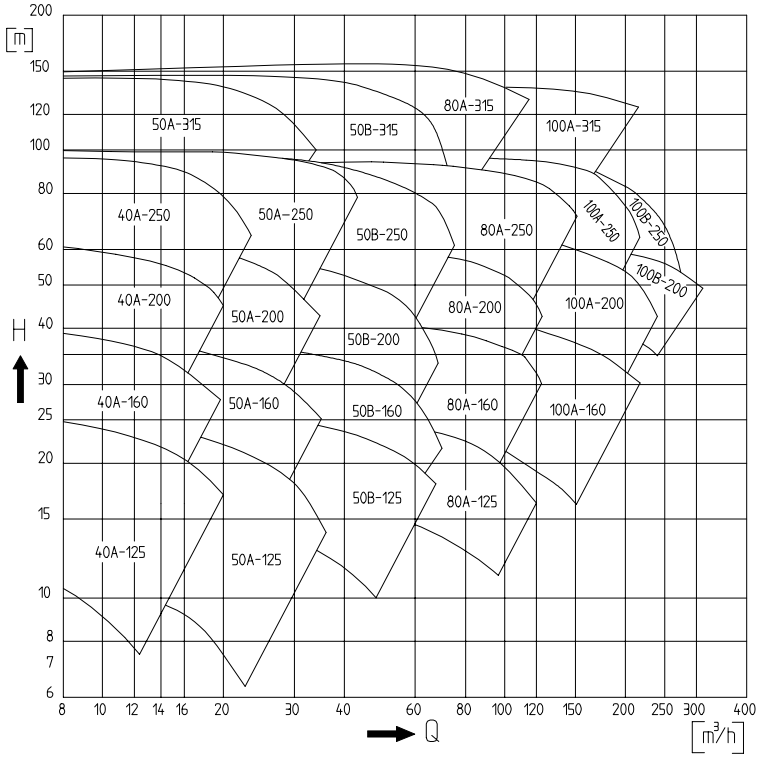


figure 21: Survey curve for stainless steel pump at 3000 min^{-1}.

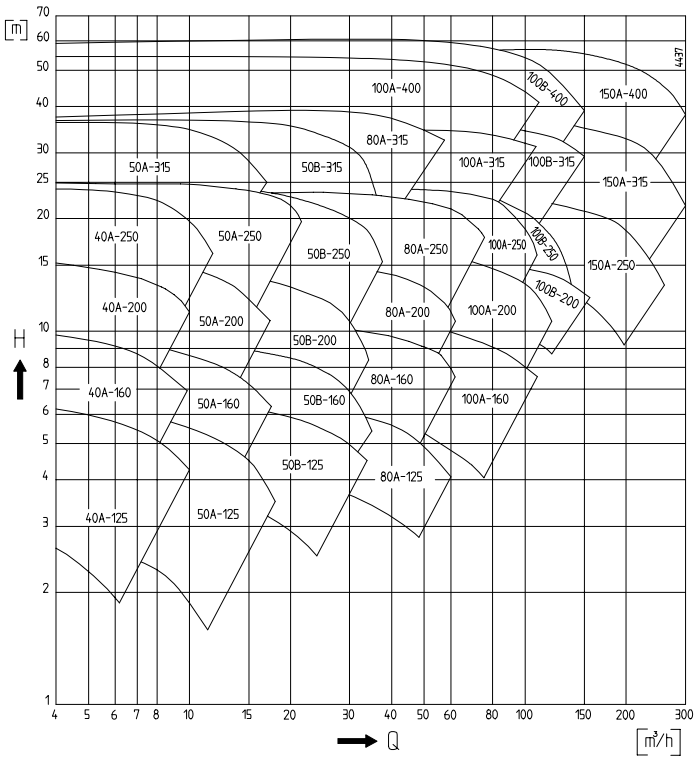


figure 22: Survey curve for stainless steel pump at 1500 min^{-1}.

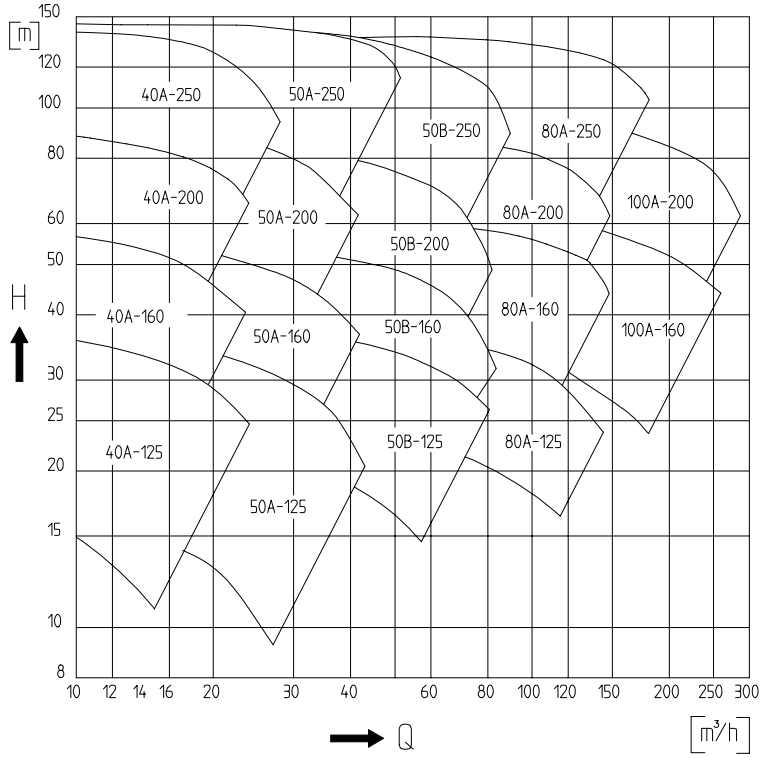


figure 23: Survey curve for stainless steel pump at 3600 min^{-1}.

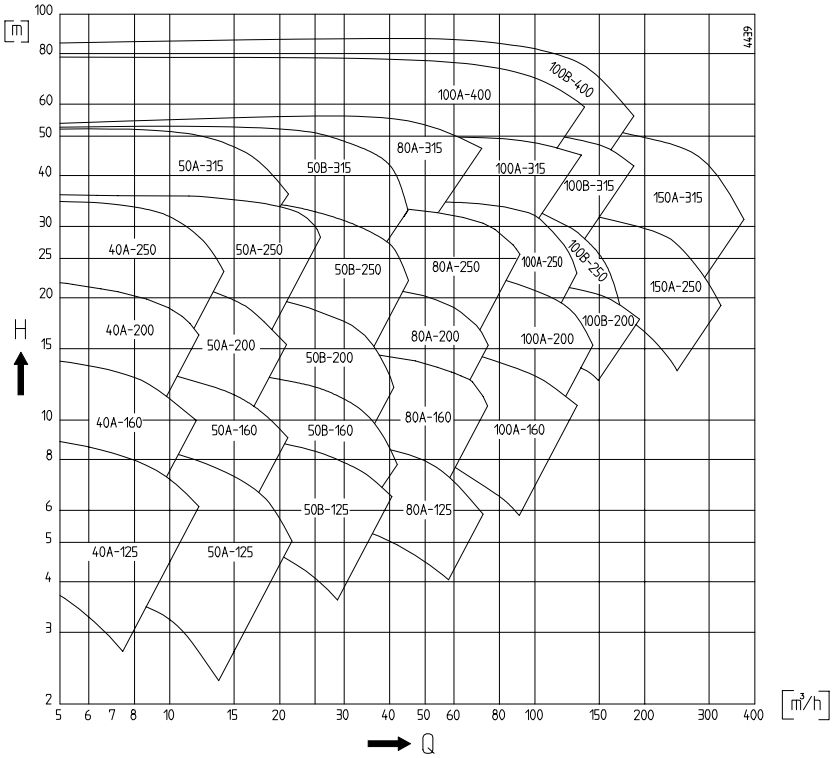
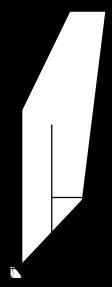


figure 24: Survey curve for stainless steel pump at 1800 min^{-1}.



10.10.2 Noise

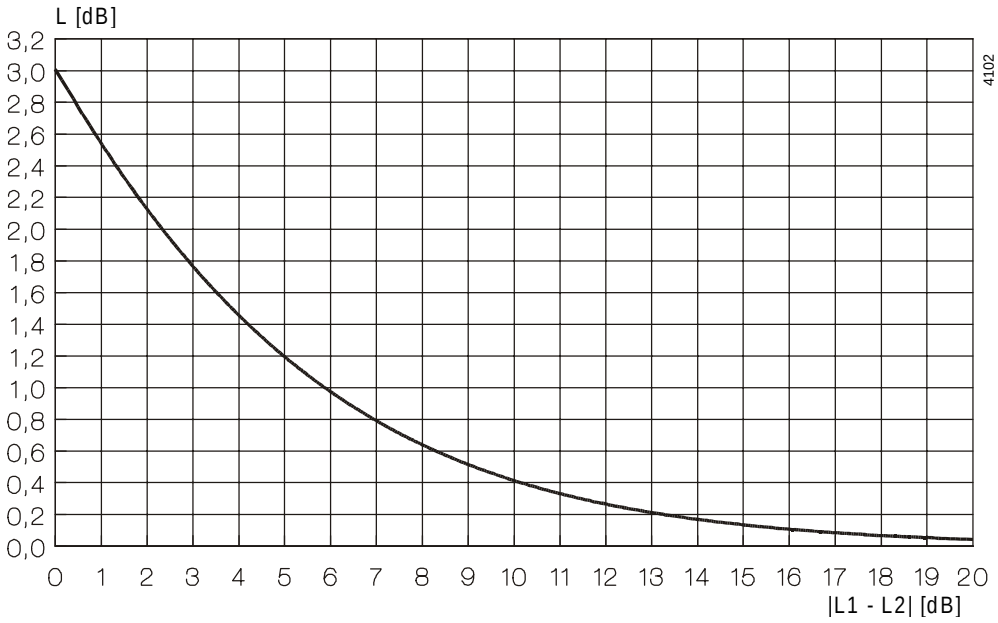


figure 27: Noise level of the entire pump unit.

In order to determine the total noise level of the entire pump unit, the noise level of the motor must be added to that of the pump. This can be easily done by using the graph above.

1 Determine the noise levels (L1 and L2), of the pump (using figure 25 or 26) and the motor.
2 Determine the difference between both levels |L1 - L2|.
3 Look for the differential value on the |L1 - L2|-axis.
4 Go up to the curve.
5 Go left to the L[dB] -axis.
6 Read the value here.
7 Add the value found in 6 to the highest noise level (L1 or L2).

Example:

1. Pump 75 dB;motor 78 dB.
2. |75-78| = 3 dB.
3. 3 dB on the X-axis = 1,75 dB on the Y-axis.
4. Highest noise level + 1,75 dB = 78 + 1,75 = 79,75 dB.

10.11 Shaft sealing

10.11.1 Specifications mechanical seals

*) arrangement 1: single mechanical seal
arrangement 2: dual mechanical seal, unpressurized
arrangement 3: single mechanical seal, pressurized

Arr. 1*	Shaft size	Flexibox	Crane	Durametallic	BW/IP
Type A (Pusher)	30	AP1M - 0476	1648	PA100	QB - 1750
		RRAR - 036A			
		RRER - 036A			
	40	AP1M - 0571	1648	PA100	QB - 2125
		RRAR - 045A			
		RRER - 045A			
	50	AP1M - 0666	1648	PA100	QB - 2500
		RRAR - 056A			
		RRER - 056A			
Type B (Bellows)	30	GT7B - 0400	1625	PB100	BX - 1500
	40	GT7B - 0500	1625	PB100	BX - 1875
	50	GT7B - 0600	1625	PB100	BX - 2250
Type C (Bellows)	30	ST1B - 0450	1635	on request	BXRH - 1625
	40	ST1B - 0530	1635		BXRH - 2000
	50	ST1B - 0630	1635		BXRH - 2375

Arr. 2*	Shaft size	Flexibox	Crane	Durametallic	BW/IP
Type A (Pusher)	30	AP1T - 0476	2648	PA200	QB - 2000/1750
	40	AP1T - 0571	2648	PA200	QB - 2375/2125
	50	AP1T - 0666	2648	PA200	QB - 22750/2500
Type B (Bellows)	30	GL1T - 0400	2625	PB200	BX - 1750/1500
	40	GL1T - 0500	2625	PB200	BX - 2125/1875
	50	GL1T - 0600	2625	PB200	BX - 2500/2250
Type C (Bellows)	30	RL1T - 0450	2635	on request	BXHW - 1750/1625
	40	RL1T - 0530	2635		BXHW - 2125/2000
	50	RL1T - 0630	2635		BXHW - 2500/2375

Arr. 3*	Shaft size	Flexibox	Crane	Durametallic	BW/IP
Type A (Pusher)	30	AP1D - 0476	3648	PA200	QB - 2000/1750
	40	AP1D - 0571	3648	PA200	QB - 2375/2125
	50	AP1D - 0666	3648	PA200	QB - 22750/2500
Type B (Bellows)	30	GL1D - 0400	3625	PB200	BX - 1750/1500
	40	GL1D - 0500	3625	PB200	BX - 2125/1875
	50	GL1D - 0600	3625	PB200	BX - 2500/2250
Type C (Bellows)	30	RL1D-0450	3635	on request	BXHW - 1750/1625
	40	RL1D-0530	3635		BXHW - 2125/2000
	50	RL1D-0630	3635		BXHW - 2500/2375

10.11.2 Dimensions shaft area

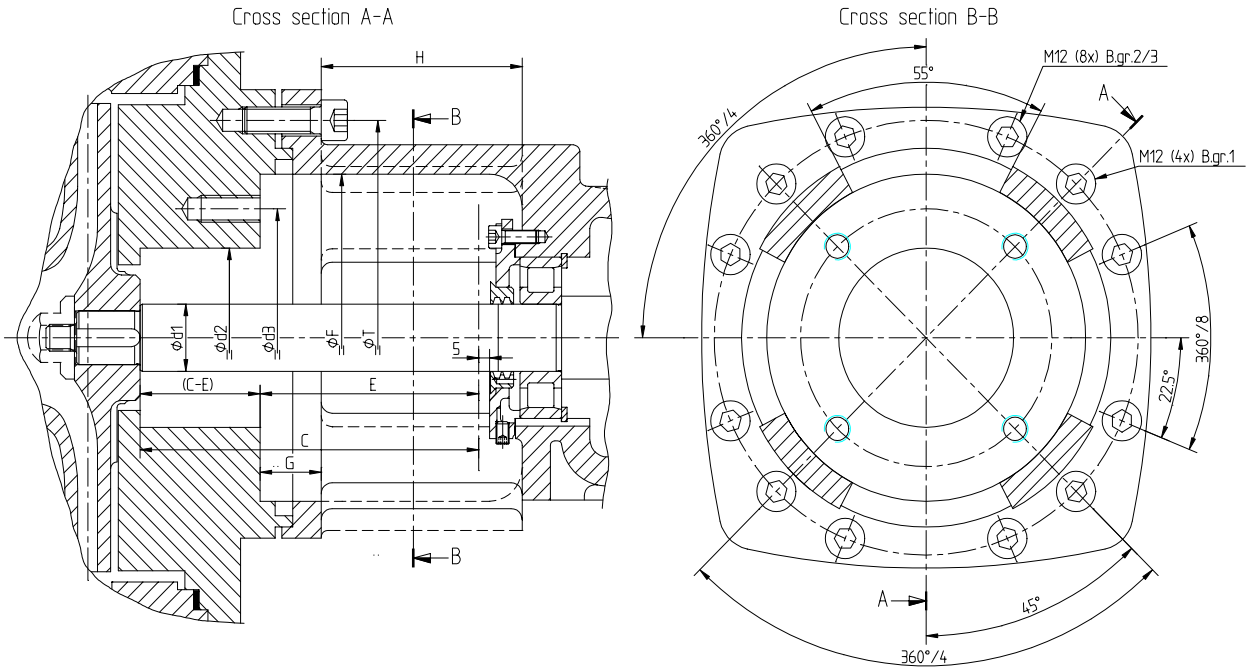


figure 28 Dimensions shaft area

Shaft seal area dimensions according to API 610, API 682

Bearing group	C	h6 d1	H7 d2	d3	E	F	G	H	T	Stud size
1	155	30	80	115	100	146	29,7	92	194	M12
2	160	40	90	125	100	160	22,9	97	210	M12
3	165	50	100	140	110	212	34,4	95,5	265	M16

10.11.3 Pressure in shaft seal area

Pressure difference in the shaft seal area above the inlet pressure and at an external circulation of the medium from delivery side, calculated for a specific mass of 1000 kg/m^3.

Pump type	Pump speed [min^{-1}] / P [bar]			
	3000	1500	3600	1800
CR 40A-125	1,8	0,5	2,6	0,7
CR 40A-160	2,7	0,7	3,8	1,0
CR 40A-200	3,8	1,0	5,5	1,4
CR 40A-250	5,3	1,3	7,6	1,9
CR 50A-125	1,8	0,5	2,6	0,7
CR 50A-160	2,4	0,6	3,4	0,9
CR 50A-200	3,9	1,0	5,7	1,4
CR 50A-250	5,5	1,4	7,9	2,0
CR 50A-315	7,7	1,9	- -	2,8
CR 50B-125	1,7	0,4	2,7	0,7
CR 50B-160	2,4	0,6	3,4	0,9
CR 50B-200	3,6	0,9	5,2	1,3
CR 50B-250	5,4	1,4	7,8	2,0
CR 50B-315	7,9	2,0	- -	2,9
CR 80A-125	1,7	0,4	2,0	0,8
CR 80A-160	2,5	0,6	3,6	0,9
CR 80A-200	3,4	0,9	4,9	1,2
CR 80A-250	5,2	1,3	7,5	1,9
CR 80A-315	7,9	3,0	- -	2,8
CR 100A-160	2,4	0,6	3,2	0,9
CR 100A-200	2,9	0,8	3,4	1,2
CR 100A-250	5,7	1,5	- -	2,1
CR 100A-315	7,0	1,7	- -	2,5
CR 100A-400	- -	2,8	- -	4,0
CR 100B-200	3,0	0,9	- -	1,3
CR 100B-250	4,3	1,1	- -	1,5
CR 100B-315	6,4	1,8	- -	2,6
CR 100B-400	- -	3,3	- -	4,8
CR 150A-250	- -	1,1	- -	1,6
CR 150A-315	- -	2,0	- -	2,8
CR 150A-400	- -	2,8	- -	3,9

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Order form for spare parts

FAX:	
ADDRESS:	

Your order will only be dealt with if this order form **has been correctly completed** and **signed**.

Order date:	
Your order number:	
Pumptype:	
Execution:	

Quantity	Pos.Nr	Part	Article number pump

Delivery address:	Invoicing address:

Ordered by:	Signature:	Telephone:

Johnson Pump Group

Parent Company

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